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A

SKETCH

OF THE

PRINCIPAL FAMILIES OF PLANTS,

EXPLANATORY OF

A Tabular View of the Vegetable Kingdom,

ARRANGED ACCORDING TO THE NATURAL ORDERS.

BY

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LONDON:
PRINTED FOR THE
SOCIETY FOR PROMOTING CHRISTIAN KNOWLEDGE;
SOLD AT THE DEPOSITORY,
GREAT QUEEN STREET, LINCOLN'S INN FIELDS:
4, ROYAL EXCHANGE; 16, HANOVER STREET, HANOVER SQUARE;
AND BY ALL BOOKSELLERS.
1855.

191. a. 27.

LONDON:
R. CLAY, PRINTER, BREAD STREET HILL.

PREFACE.

THE following sketch has been prepared as a companion to the engraved sheet illustrating the general characters of the Orders or Families of Plants. In the selection of examples for representation on the sheet, those Natural Orders were taken which, either from peculiarity of structure, from the great number of their species, or the importance of their products to man, stand out as the prominent features of the Vegetable Kingdom. A few other families, less remarkable in these respects, but at the same time possessing a certain interest, have been added in the text.

A brief Introduction is prefixed to the description of the Orders, explanatory of the principles of the Natural Classification of Plants, and of the facilities it affords for acquiring a general knowledge of vegetables by the study of a limited number of forms.

August, 1855.

INTRODUCTION.

WHEN we examine into the names of plants most familiar in the language of every-day life, we find that a large proportion of these are used in application, not to distinct, individual kinds of plants, but to classes or groups, composed of a number of kinds, agreeing more or less closely with each other in their prominent characteristics. As an example of this, we may take the word Rose, or the word Bean, and in either of these cases, the word, when used alone, will be understood to mean two or three, or even a large number of kinds of rose or bean, according to the extent of the acquaintance of the speaker with the existing kinds. Many other words occur, such as grass, tree, &c., which are still more indefinite in their meaning, and have a still greater diversity of notions attached to them, according as the person who uses them has had limited or extensive opportunities of observation or reading.

Yet, in all these cases, there is a recognition of the fact that plants, like other objects, exist in separate kinds, which may be distinguished, if we take the pains to inquire closely into them. Indeed, a rough and frequently arbitrary division into kinds, is often established in ordinary language, to facilitate the communication of ideas in the common intercourse of life. Some striking character, supposed to be peculiar to the kind, furnishes a word to add to that applied to the group of kinds: and thus we form such names, for example, as blush rose, tea rose, &c., or scarlet bean, French bean, Windsor bean, &c., applied to the kinds of rose and bean.

In this language of ordinary life we may discover the rudiments of a natural classification of vegetables. The species, genera, families, &c. of the botanists, are nothing more than the representatives of the kinds and groups of kinds spoken of above; differing from these chiefly in the strictness of the sense in which they are defined, and, consequently, in the fixed and unchangeable manner in which they are understood. Such being the case, it is not surprising to find that the earliest attempts to classify plants were true natural systems, and that it was not until the ardent pursuit of the discovery of new kinds of plants, had caused the lists and catalogues to be loaded with the names of thousands of plants of which scarcely anything was known, that botanists had recourse to an artificial method of classifying plants, with the view solely of rendering it more easy to discover the names of the kinds which had been already described. This was necessary, in fact, to form a temporary basis upon which the natural arrangement of the vegetable kingdom might be recommenced, on the foundations absolutely necessary for its security; namely, the accurate knowledge of the anatomy and physiology of the individual kinds. The best of all the artificial methods was that of Linnæus, and it is still very useful for those taking up the study of Botany, with the intention of studying the plants of a known country or district, since it enables the beginner to ascertain readily by himself the names of plants which he may meet with in nature, so that he may then turn to them in various works in which such plants have been fully described, and their natural history related. But beyond this, an artificial method is of no service; so that for persons who merely wish to gain a general acquaintance with the results of botanical science, with the natural history of plants, as it has been laid open by the investigations of botanists, it is far better to endeavour at once to master the principles of the natural classification of plants, and to proceed to the acquisition of serviceable general knowledge in the study of the natural history of the families of plants.

All scientific classifications of vegetables proceed from the same fundamental point, namely, the existence of distinct *kinds* or *species* of plants, which kinds are represented in nature by a larger or smaller number of individuals, according chiefly to external circumstances. This may be illustrated, and the idea of what is meant by a species, at the same time, be made clear, by comparing what we find upon different parts of the land upon a farm. The corn-fields we find almost exclusively filled with individuals of one particular *species* of plant, such as the common wheat, which has risen from seed sown by man. In every case, however, many *weeds* will occur intermixed, poppies, spurrey, or the like; and these will usually be of many different *species*, the seeds of which have been accidentally sown with the wheat, or have remained in the soil from its having been imperfectly cleaned. In meadows, which, to the inexperienced eye, might appear almost filled with one kind of grass, there exist really many *species* or kinds of grass, each as distinct from every other kind around it, as it is from the wheat in the neighbouring field. Among the grasses, moreover, will be found a large number of individuals of a great variety of species of herb, &c., such as kinds of sorrel, crowfoot, &c., which maintain their position there without the aid of, or in spite of, the farmer. The individuals belonging to any one of these species are found to agree with each other in almost every respect, those differences which do occur being such as manifestly depend upon accidents of soil, climate, or similar external conditions, or upon the natural development having been prevented by injuries received from animals, by strong plants having overcome weaker, and so on. A species is therefore defined as consisting of all the individuals, existing, past or future, which agree with each other in all their essential characters; the great test of the characters being *essential*, or constituting the true distinctive marks of a species, is, that they are reproduced in the new plants arising from the seeds of the individuals; and it is assumed by most botanists that the individuals of each species have, in all cases, a bond of union, not only in close resemblance, but also in a relationship of descent from a common stock; that they are, in fact, all children of one and the same parent.

We have spoken of the minor diversities displayed by different individuals really belonging to the same species. These are of considerable interest in regard to the natural history of many plants cultivated by man for food or articles of luxury. Hence, although they are not generally much dwelt upon in general systematic works, they must not be passed over without notice in these introductory observations. It is stated above, that the diversities in question depend chiefly, if not entirely, upon external circumstances. Some species are more susceptible of such impressions than others, and such is the case with most of the plants cultivated for their fruits, or as garden vegetables, in our own climate. Thus the effect of long cultivation of the cabbage in soil much richer than is natural to it, has resulted in the production of a greater number of different forms of the plant, *varieties* of the species, such as cauliflowers, savoys, sprouts, &c. Similar influences have produced similar consequences with the apple, derived from the wild crab; the pear, from a tree with an equally austere and uninviting fruit; strawberries, plums, &c., from the hedge-fruits; carrots, turnips, &c., from wild plants with roots which are mere stringy or woody taproots, not so thick as one's finger. In these cultivated plants it happens not unfrequently that the tendency to depart from the ordinary condition of the wild or natural form of the species becomes so strongly impressed upon the varieties, that they reproduce forms almost exactly like themselves by their seed, while in the ordinary *varieties* which we meet with in the fields, the peculiarities mostly die with the individuals, and the seeds produce either the natural forms of the species, or perhaps some other *varieties*. Advantage is taken of the latter fact by florists, to obtain a great multiplicity of *varieties* of favourite cultivated flowers; as, for example, of the Pelargonium, Fuchsia, &c. Market gardeners, on the other hand, do their best to maintain the unnatural conditions which have appeared to favour the production of the forms or varieties most valuable for their purposes, and thus succeed in fixing the character, to a certain extent, upon a *race* of individuals, whose seeds reproduce their like, even to the accidental characters, and will only gradually lose them, in the course of a number of generations, when neglected and allowed to run wild again.

We have to remember, then, that within the limits of a species there may exist diversities of form, some temporary, called *varieties*, and others of some permanence through succeeding generations, called *races*. These have hitherto attracted more interest from the physiologist and the practical cultivator than from the student of systematic botany; but there is no question that a thorough scientific study of these conditions is necessary to those who wish to understand thoroughly the *essential characters* of *species*, upon which all natural classification is based.

The object of classifying plants in what is called a natural system, is to bring together into a limited number of groups or assemblages the vast number of species which exist upon our globe. Some idea of their numbers may be formed from the calculations of Humboldt, that the number of species existing in Europe, either living in botanical gardens or dried in herbaria, amounts, on the lowest estimate, to 160,000, and on another to more than 200,000. It is very evident that no one person, even if he devoted the whole of a long life to them, could become acquainted with all these species, and hence there is no necessity to insist upon the utility of distributing these thousands of species into a comparatively small number of parcels or groups, each containing only such as most closely resemble one another in the majority of their most important characters. For when this is done properly, it is clear that we are enabled to obtain a good general view, or a kind of abstract, of the whole vegetable kingdom, by making ourselves acquainted with one or two of the species belonging to each of these *natural* groups.

The term *important character* has been used in the preceding remarks, and it is the signification attached to the word important that distinguishes a natural from an artificial classification. We call those characters most important, which are derived from such peculiarities of form or arrangement of the structures as indicate peculiarities in the mode of life, or what are called the physiological functions. Thus, if we find two plants which differ chiefly in the shape of their leaves, the distinguishing characters based upon this difference will be regarded as of slight importance, because it evidently cannot much affect their mode of life. But when we see one plant possessed of a stem bearing leaves, and another in which no separation of these parts can be detected, as in a lichen or a fungus, we say that these differ in a very important character, since it is evident that their modes of growth must be exceedingly unlike. Again, a plant bearing flowers and producing seeds differs in a very important character from one which, like a fern, has no flowers nor true seeds.

In forming a natural system of plants, two ways of proceeding appear to be open: one leading upwards and the other downwards. We may commence with the particular kinds or species, and combine these into groups, which shall contain a number of species of plants, distinguished from each other only by unimportant though constant characters, while they differ from all other species in those particulars in which they resemble each other. Such groups are called *Genera;* but the number of these genera in the vegetable kingdom is very large, about 6,000 according to our present knowledge. Therefore we should next proceed to combine parcels of genera together, on a similar principle, into what are called *Orders* or *Families*, each of which should contain a number of genera, agreeing with one another in a number of characters of more importance than those in which they differ, while they differ from the genera belonging to all other families in alone possessing that assemblage of important characters in which they agree. The families or orders established, according to our present knowledge of plants, vary between three and four hundred, and they exhibit great difference of degrees of resemblance to each other. Some families approach together very closely in many respects, while they are extremely unlike many other families. We therefore proceed a step further, and unite collections of families together into *Classes;* and it is, finally, found necessary to arrange these classes into a small number of *Divisions,* or, if we like to use the term, *Provinces* of the vegetable *Kingdom.*

The above was the way in which vegetables were first classified naturally; that is to say, botanists proceeded step by step, from the species of plants, which they first studied thoroughly, and then distributed them into classes, orders, &c. according to their important differences and resemblances. But now that we see in the existing natural arrangements of the vegetable kingdom, that its divisions, classes, orders, &c. are defined by characters which are derived from important physiological and structural peculiarities, we become aware that if the structure and physiology of plants in general had been thoroughly understood first of all, then a natural system might have been formed, by proceeding from above downwards, that is, by distributing all known plants, first into two or three great divisions, distinguished by some striking peculiarity in the mode of growth, then subdividing these divisions into classes, characterised by peculiarities of great importance in their mode of increase, &c., and so on, always descending to some peculiarity of less physiological and structural importance as we descend lower in our process of subdivision.

This latter plan most resembles that which the student, guided by the accumulated stores of existing knowledge, will follow with the greatest advantage, in studying systematic botany. Since a tolerably correct natural arrangement of the vegetable kingdom already exists, the object of the beginner is to master the knowledge prepared to his hands; and he will accomplish this by far the most quickly, by making himself acquainted first with the broader and more striking features, and afterwards descending into the details; for even if we lay no stress on the chances of losing himself in the endless mass of minutiæ, and giving up the study in disgust, after having only acquired a certain number of isolated facts—the study of general principles and facts of wide application will not only facilitate and render far more interesting the subsequent examination of details, but has this further advantage, that every step made in it, not only contributes to enlarge and extend the general knowledge of the student, but, should he be forced to turn aside for the present, or his opportunities of following it become limited, he will, at all events, secure in the first instance the chief outlines of the subject, a kind of bird's-eye view of it, the imperfection of which will not lie in its fragmentary character, but only the absence of the minor features, which are, in truth, of comparatively little importance to any but those who devote themselves to a serious and earnest cultivation of the science.

From these necessary introductory remarks, we shall proceed at once to the especial business of this little treatise. In the first place, we must lay down the characters of the principal or primary divisions, and of the classes into which these are subdivided. To render the perusal of these characters an acquisition of real knowledge, it is necessary that they should be accompanied by the reasons which have induced botanists to select them.

It is understood from what has already been stated, that the most important characters are those connected with the most remarkable physiological peculiarities. Now, the great general phenomenon which is most characteristic of all plants, is the overwhelming devotion of the vital energy to the process of growth, or *vegetation.* Therefore, striking peculiarities in the mode of this growth must be regarded as affording characters of the highest importance in systematic botany. When, therefore, we find one vast assemblage of plants possessing a complicated arrangement of the structures connected with vegetation, that is, with central supporting stems, bearing above ground leaves to digest and respire, and below the surface of the earth, roots to absorb the nourishment,—while another assemblage of plants exhibits no such distinction of parts in its structures, but uses any or every part at once for root, leaf, and stem,—we at once separate these two great groups from each other, and regard them as the primary divisions of the vegetable kingdom; especially as we know that differences in these respects are invariably accompanied by differences in almost all other less important particulars. Thus we obtain the commencement of a classification.

DIVISION I. Cormophytes (from *cormos,* a stem, and *phyton,* a plant).

DIVISION II. Thallophytes (from *thallos,* a vegetating branch, and *phyton,* a plant).

The Cormophytes have a stem bearing leaves, and producing leaf and fruit buds at the points of the shoots, or in the axils of the leaves.

The Thallophytes have no true leaves and stems, but the mass of the plant consists of a regular or irregular layer or frond (*thallus*) of cellular tissue, which grows at all points, and bears fruit upon any part of its surface.

The Thallophytes, however, form but a comparatively inconspicuous portion of the vegetable kingdom, as compared with the Cormophytes, and it is only in recent years that they have been so far studied as to make good their right to be separated from the mass of plants possessing stems and leaves. So that for our purpose it is more advisable to adhere to an older method of subdividing the vegetable kingdom, which places the principal boundaries in a slightly different position, but at the same time does not affect the character of the classes themselves. The best known and most important portion of the Cormophytes, making up the great body of the conspicuous vegetation of the earth, consists of those kinds which produce more or less strikingly developed *flowers,* in which are ripened true *seeds,* containing a ready-formed minute embryo at the period when they are cast off by the parent. A less important and more retiring portion of the

Cormophytes differ very strikingly from the foregoing, in the fact that they never bear true flowers, and consequently do not produce true seeds; but instead of these, minute bodies of simple structure, called *spores*, more nearly resembling the pollen dust than the seeds of the flowering plants. Now, the Thallophytes have no flowers, and are reproduced also by minute bodies of somewhat similar character, also called spores; and thus a relationship appears to exist between them and the flowerless Cormophytes. Therefore, it is possible to establish our primary division of the vegetable kingdom on the highly important characters of the reproductive system, and this is convenient for a popular exposition, although it would be more proper to use these characters for the subdivisions of the above-named primary divisions, Cormophytes and Thallophytes.

We select then the characters of the reproductive system for the primary divisions. In flowering plants these are conspicuous, presenting those varied and elegant forms and arrangements which render this part of the vegetable kingdom so attractive; hence this division is often called Phanerogamous, in contradistinction to the term Cryptogamous, plants, applied by Linnæus to plants without flowers. These two words, therefore, may furnish titles for the primary divisions:—

DIVISION 1. Phanerogamous, or Flowering Plants, characterised by possessing flowers containing stamens and pistils, from which are produced seeds containing an embryo.

DIVISION 2. Cryptogamous, or Flowerless Plants, characterised by producing spores (cellular bodies devoid of an embryo until after germination), in capsules or spore-cases, no flowers existing.

We must next proceed to subdivide these divisions. Leaving the Cryptogamous plants on one side for a moment, we look for the most important characters of Phanerogamous plants, and we find them to be evidently in the structures connected with the seeds, since seeds are not only peculiar to flowering plants, but the flowers are merely structures for preparing and perfecting the seeds. We consequently subdivide flowering plants where we find striking diversities in the structures producing the seeds, and form in this way two subdivisions, viz. :—

Subdivision 1. Angiosperms. Flowering plants producing *covered* seeds, in closed seed-vessels.

Subdivision 2. Gymnosperms. Flowering plants producing *naked* seeds, on open carpels.

The Gymnospermous plants are comparatively few, consisting of the cone-bearing plants, Firs, Pines, &c., and an exotic family of equally peculiar characters, all distinguished from the Angiosperms not only in their seed-bearing structures, but in their foliage, wood, and other respects. They may be subdivided into two classes, each containing only one family. We may turn aside from these for the present and proceed with the other subdivisions.

In the Angiosperms the seeds afford us a very important distinctive character, since the seeds of a large number of plants of this Subdivision contain an embryo with a pair of rudimentary leaves, while the seeds of the rest enclose an embryo with only one seed-leaf. This difference is accompanied by differences in the flowers, foliage, wood, and in the mode of germination of the seeds; and, therefore, the division of Angiosperms into the two following classes is very natural :—

Class 1. Dicotyledons. Angiospermous Flowering Plants, characterised by the seeds containing an embryo with a pair of cotyledons or rudimentary leaves. The woody parts of their stems are connected together into concentric rings, the veins of the leaves form a network, the segments of the flowers are mostly in circles of fives, and the tap-root is developed in the germination of the seeds.

Class 2. Monocotyledons. Angiospermous Flowering Plants, characterised by the seeds containing an embryo with a single cotyledon or rudimentary leaf. The woody fibres of the stems are separate and distinct from each other, the veins of the leaves run parallel to each other in the leaves, the segments of the flowers are in circles of three, and the radicle of the embryo is never developed into a tap-root in the germination.

Each of these two classes of Flowering Plants contains a very considerable number of natural families; and, therefore, for the sake of convenience, they are broken up into a number of sections. These sections are differently planned by different botanists; the arrangement of Decandolle is selected here because more generally in use than that of Jussieu. In neither case, however, are the sections really *natural* groups, since they are made to depend upon a single character; thus in some cases families nearly related in many other respects, are removed widely apart. The character of the sections will be given further on, in the tabular view of the arrangement of the Vegetable Kingdom.

The 2d division, consisting of Cryptogamous plants, is subdivided, first, into two portions, characterised very distinctly.

Subdivision 3. The Acrogens. Cryptogamous plants having a distinct stem clothed with leaves, and taking their name from the mode of growth, from *points* or buds, formed in particular situations.

Subdivision 4. The Thallophytes. Cryptogamous plants with the vegetative structure consisting of an expanded mass or layer of cellular tissue, growing with more or less irregularity in all directions.

Each of these subdivisions contains a number of families, and may be broken up into several classes, which, like the two great classes of the Angiospermous Flowering Plants, are very natural. The characters of these are given in the tabular view which is here subjoined.

THE VEGETABLE KINGDOM.

- I. DIV. PHANEROGAMIA. Flowering plants, bearing Seeds.
  - I. *Subdiv.* *Angiospermia.* The Seeds borne in closed cases.
    - 1st Class. Dicotyledones. The Seeds with a Two-leaved Embryo.
      - 1st *Sect.* *Thalamifloræ.* The Stamens affixed to the Receptacle.
      - 2d — *Calycifloræ.* „ „ „ Calyx.
      - 3d — *Corollifloræ.* „ „ „ Corolla.
      - 4th — *Incompletæ.* The Floral envelopes in one circle, or absent.
    - 2d Class. Monocotyledones. The Seeds with a One-leaved Embryo.
      - 5th *Sect.* *Petaloideæ.* The Perianth large and coloured.
      - 6th — *Spadicifloræ.* The Perianth inconspicuous, Flowers on a Spadix.
      - 7th — *Glumoideæ.* The Perianth scaly, imperfect.
  - II. *Subdiv.* *Gymnospermia.* The Seeds borne on open Carpels.
    - 3d Class. Coniferæ. Stems branched, growing like Dicotyledons.
    - 4th — Cycadaceæ. Stems unbranched, growing like Monocotyledons.
- II. DIV. CRYPTOGAMIA. Flowerless plants, bearing Spores.
  - III. *Subdiv.* *Acrogenes.* With stems bearing leaves.
    - 5th Class. Lycopodiales. With distinct capsules, containing spores of two kinds, analogous to pollen and ovules.
    - 6th — Filicales. Bearing spores of one kind on the backs of the leaves, or in spikes or cones.
    - 7th — Bryales. Minute leafy plants, bearing one kind of spore in stalked capsules.
    - 8th — Characeæ. Aquatic filamentous plants, bearing whorls of branches, and rooting, with two kinds of reproductive organs.
  - IV. *Subdiv.* *Thallophyta.* Flowerless plants without stems; the vegetative structure composed of cellular expansions.
    - 9th Class. Fungales. Thallus of colourless flocculent filaments, growing in water or damp ground, &c. Fruit in the air.
    - 10th — Lichenales. Thallus crustaceous, and, like the Fruit, growing in the air.
    - 11th — Algales. Thallus a leaf-like cellular layer, a ramification of filaments, or collection of isolated cells, growing in water or damp air; red, brown, or green. Fruit under water.

The foregoing synopsis will serve to show the relative values of the different Subdivisions and Classes, in a structural and physiological point of view. It will be unnecessary to give here a more extensive synopsis, showing the arrangement of the Orders contained in the Classes, because the mode in which they are arranged in the following pages will indicate the places of the Orders. Moreover, a list of the principal Orders in each Class will be given separately at the commencement of the descriptions of these. For the convenience, also, of those who have some little knowledge of the characters of plants, such as may be gained from the ordinary rudimentary works,[1] we place at the end of the descriptions of the Orders a kind of artificial analysis of them, which will enable the learner, in most cases, to find out readily to what order an unknown plant belongs. In this analysis are included *all* the orders of plants, many represented only by rare or exotic species; for the further descriptions of which larger descriptive works, such as Lindley's "Vegetable Kingdom," must be consulted.

PHANEROGAMIA.

ANGIOSPERMIA.

DICOTYLEDONS.

THALAMIFLORÆ.

1. Ranunculaceæ.
2. Magnoliaceæ.
3. Berberidaceæ.
4. Nymphæaceæ.
5. Nelumbiaceæ.
6. Papaveraceæ.
7. Fumariaceæ.
8. Cruciferæ.
9. Capparidaceæ.
10. Resedaceæ.
11. Violaceæ.
12. Caryophyllaceæ.
13. Malvaceæ.
14. Sterculiaceæ.
15. Byttneriaceæ.
16. Tiliaceæ.
17. Guttiferæ.
18. Hypericaceæ.
19. Geraniaceæ.
20. Linaceæ.
21. Aurantiaceæ.
22. Vitaceæ.
23. Ternstrœmiaceæ.
24. Rutaceæ.

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[1] For instance, the author's "Rudiments of Botany," which would form a good introduction to this Treatise.

1. RANUNCULACEÆ.

Helleborus niger. Black Hellebore. Flowers and leaves arising from a creeping underground stem.—*Ranunculus bulbosus.* The common Buttercup. A sprig with flowers; *pt.* a petal showing the scale at the bottom; *stp.* the pistils and 2 stamens left after removing the calyx, corolla, and most of the stamens; *fr.* the fruit, composed of the enlarged dry pistils; *fr.* l, one of the portions of the fruit cut through, to show the single seed filling it, with the small embryo at the bottom.—*Aconitum Napellus.* Monkshood. A spike of flowers and a short piece of a stem with a leaf; *stpt.* the stamens with the irregular petals left after the removal of the coloured calyx; *fr.* the ripe fruit.

This order consists of plants which are mostly herbaceous, in a few cases shrubby, bearing leaves ordinarily much divided, with the stalks expanded, and sheathing at the base, generally arising alternately (opposite in *Clematis*). The arrangement of the flowers varies much; sometimes they are accompanied by an involucre formed of 3 leaves (*Anemone*). The calyx is composed of a variable number of free sepals, valvate or imbricated in the bud, often coloured and petaloid (*Anemone, Aconitum,* &c.), and often of curiously irregular form, generally deciduous. The corolla is sometimes absent (*Anemone, Clematis, Hepatica,* &c.); when present, it consists of a number of free petals, either flat, with a little gland at the base (*Ranunculus*), rolled into little tubes (*Helleborus*), or horn-like bodies with a spur (*Delphinium*), or scroll-like bodies on a long stalk (*Aconitum*). The stamens are usually very numerous, inserted on the receptacle, free, and with the connective continuous with the filament. The carpels are simple and free, but present two principal modifications; being sometimes (*Ranunculus, Anemone, Clematis,*) one-seeded, and ripening into a hard, seed-like indehiscent body (achene); sometimes longer, with several seeds one above another, attached to the internal suture, and ripening into a kind of pod (follicle), bursting down this suture to discharge the seeds. The simpler form generally occurs in large numbers in a kind of pyramidal heap; the long many-seeded carpels are usually 3 or 5 in number, standing in a circle (sometimes slightly adhering together below). The style is very short, usually lateral, the stigma simple. The fruit consists either of a collection of achenes, a circle of follicles (free or connected together below), or very rarely of a berry (*Podophyllum*). The embryo is very small, situated at the base of a horny or fleshy endosperm.

The Ranunculaceæ are usually acrid plants, sometimes, as in the genus *Aconitum*, very poisonous. A number of favourite garden plants belong to this family, as also a considerable number of British wild flowers, the family being characteristic of cool damp climates. They may be divided into 4 tribes:—

1. ANEMONEÆ. Characterised by one-seeded, indehiscent fruits and a simple perianth (calyx mostly coloured); to this belong *Clematis, Atragene, Anemone, Thalictrum, Hepatica, Adonis.*

2. RANUNCULEÆ. Fruits 1-seeded, indehiscent, perianth double (a calyx and corolla). The genus *Ranunculus,* to which belong our common Crowfoots and the Butter-cup; *Ranunculus Ficaria,* is the "Lesser Celandine," a favourite with Wordsworth. All the *Ranunculi* are acrid when fresh, some exceedingly so, blistering the skin.

3. HELLEBOREÆ. Fruits (follicles) many-seeded, bursting, petals concave, irregular. Among these are the common Marsh Marigold (*Caltha*), the Hellebores, *Nigella, Aquilegia* (Columbine), *Delphinium* (Larkspur), *Aconitum* (Monkshood), &c. The last is the most poisonous of the family.

4. PÆONIEÆ. Fruits (follicles) many-seeded, petals flat. This tribe includes *Pæonia,* the peonies, remarkable for their large and beautiful flowers.

2. MAGNOLIACEÆ.

The plants of this order are trees or shrubs, the Magnolias being well known in gardens for their large and beautiful scented flowers. The leaves are leathery and furnished with stipules, which are folded over the buds, and fall off when these open. The sepals and petals vary from 3 to 6 in number, the stamens are numerous, as are also the distinct carpels, which form either a circle, or a kind of cone, in the centre of the flower.

These plants have aromatic and tonic properties. Besides the Magnolias, the Tulip-tree of our gardens (*Liriodendron tulipifera*) belongs to this order.

3. BERBERIDACEÆ.

The genus *Berberis*, with *Mahonia*, now separated from it, includes, besides the common Berberry, a number of shrubs with spiny and sometimes pinnate shining leaves, which have lately become common in cultivation. The Berberries are acid, and astringent.

4. NYMPHÆACEÆ.

Nuphar luteum. The common yellow Water-lily. A detached flower; *p.* the compound pistil from the centre of ditto, *p.*—, the same cut across to show the chambers and seeds. —*Nymphæa alba.* The white Water-lily. A flower with buds and leaves floating on the water.

The wonderful *Victoria regia* has recently attracted great attention to this order, consisting entirely of water-plants with large floating leaves and flowers of sometimes enormous dimensions and great beauty. They all have a more or less solid rootstock growing in the mud at the bottom of the water, either horizontally, as *Nuphar* (the yellow Water-lily), or erect, with the leaves arranged in beautiful spirals, as in *Victoria.* The leaves are borne on long stalks, so as to rise and lie flat on the surface of the water; they are either round or heart-shaped, and undivided; in Victoria they attain a diameter of as much as 12 feet and more, and present a very curious arrangement of projecting ribs on the under side. The flowers arise singly in the axils of the leaves, and the buds rise on long foot-stalks to the surface of the water, to open, afterwards closing and sinking again to ripen the seeds. The calyx is ordinarily composed of 4 free sepals, within which are found sometimes a single (*Nuphar*), sometimes many (*Nymphæa, Victoria*) circles of petals; in the latter case these become smaller toward the interior, and pass gradually into the circles of stamens. The stamens are numerous, inserted either below the ovary or upon its outer wall. The ovary is compound, containing numerous cells, and is either superior (*Nuphar, Nymphæa*), or inferior (*Victoria, Euryale*), the stamens and petals being adherent to it in the last case. The summit of the ovary is flat and bears a number of stigmas (equal to the internal chambers) radiating from its centre. The fruit is fleshy and indehiscent, with a number of chambers containing many starchy seeds.

These plants are chiefly remarkable for their beauty; but they are also of some economical importance in the countries where they abound. In India, many species of Nymphæa occur in the rivers and lakes, and some of these produce corms or solid bulb-like structures, which contain much starch and are used for food. The rootstocks also contain much starch in the season of rest; and the starchy seeds of *Victoria* are roasted and eaten by the natives of those warm parts of South America where this plant is found.

Nymphæa alba is the wild White Water-lily, *Nuphar lutea*, the Yellow one.

5. NELUMBIACEÆ.

An order nearly related to Nymphæaceæ, distinguished especially by the peculiar fruit, consisting of a hemispherical, flat-topped body, with the nuts sunk in little open chambers on the top. *Nelumbium speciosum*, the Sacred Water-bean, is the Egyptian Lotus, represented on the ancient monuments of Egypt and India. The nut of it is supposed to be the Pythagorean bean.

6. PAPAVERACEÆ.

Papaver Rhœas. The common red field Poppy. A flower opened and a bud; *stp.* the pistil and a few of the stamens; *p.*—, the pistil cut across to show the imperfect partitions and the young seeds.—*Chelidonium majus.* Common Celandine. A flowering sprig; *fr.* the fruit opening naturally; *fr.*—, the fruit cut across.

Herbaceous plants with alternate leaves, without stipules, which, with the stems, contain a juice turning milky when exposed to the air, either white or yellow in colour. Flowers solitary or in racemes. Calyx usually of two, sometimes three sepals, free or united into a kind of hood (*Eschscholtzia*), all falling off when the corolla expands. The corolla is usually composed of 4 free petals, sometimes of 6. The stamens vary from 8 to 24 or more. The ovary is always 1-chambered, and either urn-shaped with many parietal placentas (*Papaver*), or long and slender, with only 2 placentas (*Chelidonium, Eschscholtzia*). The style is very short or undistinguishable, the stigmas equal in number to the placentas of the ovary, and in Papaver radiating on the flat top of the ovary. The fruit of the Poppy (*Papaver*) is a capsule containing many seeds, which escape by pores formed around the top of the side-wall under the projecting stigmatic disk. In the Celandine (*Chelidonium*) and other genera with linear ovaries, the fruit is a pod, which opens by 2 valves like the pod of the Wallflower.

The Papaveraceæ are chiefly remarkable for the narcotic property of the milky juice of many kinds; but in some genera this juice is acrid. They are mostly natives of temperate climates.

Several species of Poppy (*Papaver*) are wild in this country, the opium poppy (*Papaver somniferum*), which has pale lilac petals with an inky blotch in the centre, is naturalized in many places. Opium is obtained by collecting the juice which exudes from the green unripe capsules when cut across. When ripe, this capsule is dry and woody, and the numerous seeds it contains yield a harmless oil much used in the arts, and for adulterating olive oil. Poppy oil-cake even has been given to cattle. The Celandine (*Chelidonium majus*), a weed growing about hedges, generally near villages, is remarkable for the yellow colour of the milky juice. The Californian Eschscholtzias are favourite garden plants, and the yellow horned poppy (*Glaucium luteum*), abundant in many places on the shingle of the sea-coast, is remarkable for the large yellow flowers and the glaucous colour of its broad, tough foliage,

7. FUMARIACEÆ.

This order is nearly related to the Papaveraceæ in many respects, but differs in the plants having a watery juice, and the irregular flowers having either only 4 stamens or 6 arranged in two parcels. Besides the Fumitories (*Fumaria*), and various species of *Corydalis*, this family includes the showy garden flower *Dielytra spectabilis*.

8. CRUCIFERÆ.

Cheiranthus Cheiri. The Wallflower. A flowering sprig; *stp.* the stamens and pistil after the calyx and corolla have been removed; *p.* |, the pistil cut open perpendicularly; *p.*—, the pistil cut across. — *Capsella Bursa-pastoris.* Shepherd's Purse. A sprig with flowers and fruits, and a root with radical leaf; *fr.* the fruit opening naturally.

A large and very natural order of plants, principally herbs, growing in temperate and cold climates. They are especially distinguished by their 4-sepalled calyx, corolla of 4 petals arranged in a cross, and their 6 stamens, 4 long and 2 short, (they correspond, therefore, exactly to the Tetradynamia of the Linnæan classification). The ovary is also peculiar, consisting of a long and slender (silique), or short and broad, flat or inflated (silicle) 2-chambered pistil, which has 2 rows of ovules in each chamber, at the edges of the partition. When ripe, the fruit opens by 2 valves separating from the framework supporting the partition and the seeds. The seeds are without endosperm, and have the cotyledons folded up in various ways, which, with the form of the fruit, afford characters for the subdivision of this very extensive order.

The watery juice of the foliage of the Cruciferæ is commonly pungent (sometimes even acrid) in its characters. The seeds contain an oil which is in many cases mild and bland, in others impregnated with a substance which acquires acrid properties when brought in contact with water. Several species which have been in cultivation from time immemorial are remarkable for the great development of succulent tissue in their roots, stems, or foliage. Many of the Cruciferæ are ornamental garden plants. Among the best known and most important plants of this family, are the following:—

Pungent herbs, used for salads, and as antiscorbutics: Water-cress (*Nasturtium officinale*), Garden-cress (*Lepidium sativum*), Mustard, black and white (*Sinapis nigra* and *alba*), the former being that of which the powdered seeds are used for the sake of the acrid product; Horse-radish (*Cochlearia Armoracia*); Common Radish (*Raphanus sativus*).

Herbs, more or less pungent when wild, bland and very succulent in the highly cultivated varieties: the common Turnip (*Brassica Rapa*), the Swede (*Br. campestris*). Cabbages and Greens of all kinds consist of the foliage, Brocoli and Cauliflower of the succulent unexpanded inflorescence, of *Brassica oleracea;* Sea Kale (*Crambe maritima*).

Various species are of high importance for the fixed oil contained in their seeds, as also for the oil-cake, consisting of the mass of seeds from which the oil has been expressed. Rape is *Brassica napus;* Colza, *Br. Rapa oleifera* (a variety of the common Turnip); Summer rape, *Br. præcox;* Gold of Pleasure, *Camelina sativa.*

Of the garden flowers may be enumerated the Wallflower (*Cheiranthus*), the Stocks (*Matthiola*), Candytuft (*Iberis*), *Alyssum, Erysimum,* and others; a large number of Cruciferæ grow wild in this country. The Shepherd's-purse (*Capsella Bursa-pastoris*) is, perhaps, next to Chickweed, the commonest weed we have.

9. CAPPARIDACEÆ.

This is an order of plants allied to the Cruciferæ in their properties, consisting chiefly of tropical plants. The flowers have 4 parts in the calyx and corolla, but they may be generally distinguished by the large number of stamens, and when there are but 6, these are not tetradynamous. The ovary also has no septum, and is therefore 1-celled. The flowers of these plants often present a curious appearance, from the envelopes, stamens, and pistil being more or less separated from each other by intermediate pieces of stalk, or elongated receptacle.

The Capparidaceæ are pungent, and the species of *Capparis* furnish capers, which are the flower-buds. Several species grow in the different countries around the Mediterranean.

10. RESEDACEÆ.

An order chiefly remarkable for the fleshy disk upon which the stamens are inserted, the fringed, unequal petals, and the capsule, which opens at the summit before the seeds are ripe. All these points are seen in the common Mignonette (*Reseda odorata*). These plants have no active properties. *Reseda luteola* (Weld) yields a blue dye.

11. VIOLACEÆ.

The Violet order consists of herbs or shrubby plants, with stipulate leaves, flowers mostly irregular, with compound ovaries, bearing parietal placentas, crowned by a single style with a thickened stigma. In the genus Viola, to which our Violets and the Heartsease belong, the flowers are irregular, the lower of the five petals being spurred, and two of the anthers having spurs which pass down into the pouch of the petal.

Viola odorata is the sweet Violet; *V. tricolor*, the Pansy, or Heartsease. The Violaceæ, ordinarily, have emetic properties.

12. CARYOPHYLLACEÆ.

Dianthus Caryophyllus. The Clove-pink or Carnation. A single (wild) flower; *fr.* the fruit burst naturally. — *Stellaria Holostea.* Stitchwort. A flowering sprig; *stp.* the stamens and pistil after the removal of the calyx and corolla.

The plants of this order are herbs, seldom of considerable size; remarkable for the swellings upon the stems, at the places where the pairs of opposite leaves arise; this is well seen in the common Pink. The flowers are arranged in cymes, and have a calyx composed of either 4 or 5 sepals, free or conjoined. The petals likewise vary from 4 to 5, in different cases, or they may be altogether wanting. The stamens are generally equal in number, or double the number of the petals; rarely fewer. The centre of the flower is occupied by a compound ovary, usually 1-celled, with a central placenta, sometimes borne on a short stalk, and crowned by 2 to 5 styles. The ovary ripens into a dry capsule, which either bursts by valves, equal in number to the styles, or the upper part alone opens, and the walls separate and turn out to form a crown of teeth, twice as many as the styles.

The plants of this family are not of much importance, except for the beauty of the cultivated forms of some genera, such as *Dianthus*, to which belong the Pinks, Carnations, Picotees, &c. of gardens. Some species of *Lychnis* and *Silene* are also favourites. *Stellaria media* is the common Chick-weed.

13. MALVACEÆ.

Malva sylvestris. The common way-side Mallow. A flowering shoot; *stp.* the monadelphous stamens after the removal of the calyx and corolla; *stp.* | , the same cut open perpendicularly, showing the pistil in the centre of the tube of the stamens; *fr.* the fruit. — *Gossypium herbaceum.* The Cotton plant. A sprig with an open flower, an unopened fruit, and one (the uppermost) burst, with the cottony seeds escaping; *s.* a seed showing its *coma* of hairs, constituting cotton.

The Malvaceæ are either herbs, shrubs, or trees, with broad, alternate leaves of palmate character. The flowers grow from the axils of the leaves, and present an outer green calyx or involucre, besides that immediately surrounding the corolla; the true calyx and the (often brilliant and conspicuous) corollas have each 5 parts. The numerous stamens have the filaments all coherent into a tube surrounding the style, bearing the many anthers, which have only one cell, at its upper edge or mouth; the ovaries are composed of a variable number of carpels, either united into a many-celled ovary, with the placentas in their axis, or merely coherent imperfectly, and separating into distinct nuts when ripe; the cells of the ovary contain either 1 or several seeds. The styles equal the carpels in number, and are distinct or united up to the stigmas.

The Malvaceæ have mucilaginous properties, but they are chiefly remarkable for the *textile substances* yielded by different genera; also for their beautiful flowers.

The Marsh-mallow (*Althæa officinalis*) was formerly much esteemed as a demulcent, and still holds its place among medicinal substances; the French use it largely in the *pâte de Guimauve*, as a remedy for coughs.

Althea rosea, the Hollyhock, has similar qualities, as also the wild Mallow, *Malva sylvestris*.

The various kinds of cotton are furnished by the genus *Gossypium*. The fibre consists of the hairs which clothe the seeds. There are several kinds of cotton plants,—*G. arboreum*, *G. herbaceum*, *G. barbadense*, *G. peruvianum*, and *G. acuminatum*. The value of cotton depends upon the length of the filaments (staple), as also on its toughness, and the care with which it is freed from the oily seeds.

Various species of *Sida* and the Indian *Hibiscus cannabinus*, contain fibres in their bark or rind, which are used as hemp. The fibres of the Malvaceæ have been suggested as likely substances to furnish a good material for the manufacture of paper.

14. STERCULIACEÆ.

Cheirostemon platanoides. The Hand-plant of Mexico. A flowering sprig. *fl.* +, a flower laid open to show the structure; *fr.*—, the pistil cut across.—*Adansonia digitata*, the Baobab or Monkey Bread-tree; with a detached flower.

An order of trees or shrubs, with simple or compound, and sometimes digitate leaves. They bear much resemblance to the Malvaceæ, but are distinguished by the anthers being constantly 2-celled, facing outward. Their flowers are also often unisexual. They are tropical plants, also resembling the Malvaceæ in their properties.

Adansonia digitata, the Baobab or Monkey Bread-tree, is remarkable for the enormous size which it attains; it is a native of Senegal, and trunks have been measured there thirty feet in diameter. The large ovate fruit contains an acid pulp, from which a drink is made, also a considerable quantity of starch. Its bark yields useful fibres. The species of *Bombax,* or Silk-cotton, have hairs around the seeds, like cotton; these, however, are too smooth to allow of spinning, and are only used for stuffing cushions, &c. *Chorisea spinosa* has a like use. The bark of a species of *Sterculia* yields fibres from which cordage and cloth are made.

The *Cheirostemon platanoides,* or Hand-plant of Mexico, is remarkable for the strange form assumed by the anthers, like the fingers of an opened hand. It was regarded with a religious veneration or awe by the ancient Mexicans.

15. BYTTNERIACEÆ.

This order is closely related to the Malvaceæ and the Sterculiaceæ, but has the tube of its stamens less extensively developed than the former, and the anthers 2-celled, and these being turned inwards thereby separate the family from the Sterculiaceæ, in which the 2-celled anthers are extrorse.

The Cacao-tree, *Theobroma Cacao,* growing wild in the forests of Demerara, attracts attention to this family, since its seeds, the Cacao beans, furnish what are called in commerce Cocoa-nibs, and the material of Chocolate. For Cocoa, the seeds are merely roasted and powdered; for Cocoa-pastes and Chocolate, the powder is made up into a paste with sugar, chocolate being flavoured with vanilla and cinnamon, and coloured with annatto. Chiefly tropical or sub-tropical.

16. TILIACEÆ.

Trees or shrubs, of which the common Limes are familiar examples. They resemble the three preceding orders in various respects; but their stamens are free, situated on the outside of a disk. The majority of the species are tropical; but those of temperate climates form trees. They are generally remarkable for the fibrous substance of the inner bark, the *liber*, which in the Lime, *Tilia europæa,* furnishes Bast or Bass, while *Corchorus capsularis,* an Indian species, yields the *Jute* fibre, a substance coming into very extensive use as a material for cordage, canvas, &c.

17. Guttiferæ.

Cambogia Gutta. The plant yielding Gamboge. A sprig with flowers; ♀, a flower producing seed; ♂, a barren flower containing stamens; *a* an anther; *fr.*—, the fruit cut across. — *Garcinia Mangostana.* The Mangosteen. A shoot with flowers and fruits; *fl.* a flower; *fr. fr.* fruits; *fr.* +, a fruit opened to show the seeds.

The Guttiferæ are trees or shrubs, with entire leathery opposite leaves, containing a resinous juice. They are related to the Hypericaceæ, but differ from them in the single stigma, and the few ovules in the cells of the ovary, as also in the presence of the acrid juice. They are natives of the tropics of both hemispheres. These plants, although containing an acrid juice in the foliage and succulent structures, sometimes furnish delicious and innocuous fruits. Thus while *Cambogia gutta* furnishes the drastic purgative Gamboge, and some species of *Garcinia* also yield a substance of the same kind, known in commerce by the same name; another species, *Garcinia Mangostana,* furnishes the Mangosteen, said to be one of the finest pulpy fruits in existence. The South American Mammee apple, a mild aperient, is the fruit of *Mammea americana.*

18. Hypericaceæ.

The St. John's Worts are herbs, shrubs, or trees, with opposite entire leaves marked with transparent spots, consisting of glands containing a resinous substance. The flowers are regular, with 4—5 sepals, and 4—5 petals, often glandular. The numerous stamens are usually united into several parcels, and the compound ovary is crowned by as many styles as there are stigmas (3—5). Many species of Hypericaceæ are natives of temperate climates, but the plants of this family are equally distributed in hot climates. They are usually purgative, and contain coloured juice and an essential oil; some have a gum-resin, like the Guttiferæ.

19. GERANIACEÆ.

Geranium Robertianum. Common wild Geranium or Herb-Robert. A flowering sprig; *stp.* stamens and pistils after the removal of the calyx and corolla; *p.* pistils; *fr.* ripe fruit. — *Pelargonium.* The garden Geranium.

The most remarkable point in this order is the structure of the ovary and fruit, whence they derive their names of Cranes'-bills, Storks'-bills, &c. They are herbs or shrubs, with swollen joints and alternate or opposite leaves, entire or lobed, with the veins on the palmate plan. The sepals and petals are 5 in number, entire, regular (Geranium), or irregular (*Pelargonium*). The stamens, mostly 10, are slightly coherent below, sometimes a portion are barren. The ovary is composed of 5 carpels, each forming a 2-ovuled cell, and prolonged above into a tail, which with its fellows is at first adherent to a central column prolonged from the receptacle. When the fruit is ripe the carpels start out of their seats, and the tail separates from the column, twisting up as it dries, except at its upper end, so that the column bears the five ripe carpels suspended freely from its summit. The Geraniaceæ have no important properties. The genera *Geranium* and *Erodium* are weeds in temperate climates. The garden "Geraniums" are species of *Pelargonium*, chiefly derived from the Cape of Good Hope.

20. LINACEÆ.

A small order of herbs with sessile entire leaves and regular flowers. All parts of the flower, sepals, petals, stamens, and carpels, vary between 3 and 5. The stamens are dilated at the base, as in Geraniaceæ, and, as in some of those, there are often intermediate barren stamens between the perfect ones. The styles are free, equal to the number of carpels in the compound ovary, which has as many true cells or chambers, but these are each more or less completely divided into two by a septum running in from the dorsal suture.

The most important plant of this family is the Flax, *Linum* *usitatissimum.* Besides its valuable fibre (the liber) used for *linen,* its seeds contain not only a mucilage but a fixed oil, the well-known Linseed-oil, of a peculiar drying quality, rendering it highly valuable in the arts. The residue after the expression of the oil, linseed cake, is largely used for feeding cattle, and in a ground condition as a manure.

21. AURANTIACEÆ.

Citrus Aurantium. The Orange-tree. A flowering shoot; *st.* stamens, on the right in place, in the left-hand figure detached; *p.* pistil; *p.* | , pistil cut open perpendicularly (with one stamen in place); *fr.* the fruit cut across.

The Aurantiaceæ are trees or shrubs, with alternate leaves, dotted with glands and devoid of stipules, and very fragrant flowers. The calyx is short, cup or bell-shaped, 3—5 toothed; the petals from 3—5; the stamens equalling the petals in number, or some multiple of them, inserted with them on a glandular disk, sometimes coherent by their filaments into several parcels; ovary free, many-celled, style cylindrical, stigma thickened, fruit a pulpy compound ovary, with a leathery rind, as in the orange, &c. The plants of this family are chiefly derived from Southern Asia. The species of Citrus are most remarkable for their delicious pulpy fruit, and aromatic oil of the rind and the leaves. The sweet orange is *Citrus Aurantium;* the Seville orange, *C. vulgaris,* is perhaps only a variety; the flowers of this yield neroli oil: the lemon is *C. Limonum,* the lime *C. Limetta,* and its variety *Bergamia* the Bergamot orange. The Citron is *C. Medica,* the Shaddock *C. decumana.* *C. paradisa* yields the kind called "Forbidden Fruit." *C. Pompelmos* and *C. japonica* are other edible species.

22. VITACEÆ.

An order of no great extent, but of high importance from its including the Grape-vine. The plants are shrubby, climbing by tendrils, and bear small green flowers, having a small almost toothless cup-like calyx and petals falling very early, sometimes united by their tips, and falling off in one piece (*Vitis*). Inside the petals there is a disk, upon which are inserted the 4 or 5 stamens, opposite the petals. The ovary is usually 2-celled, with 2 ovules in a cell. It ripens into the well-known form of berry presented by the grape.

The Grape-vine is supposed to be a native of the countries bordering on the Caspian. It has indeed been known in Europe from the earliest recorded periods, and is naturalized or half wild in Sicily and elsewhere, but it grows nowhere so luxuriantly, out of cultivation, as on the mountains south of the Caspian; its botanical name is *Vitis vinifera.* The favourite climbing plants, the *Ampelopsis hederacea,* &c., or Virginian Creepers, so remarkable for the red colour assumed by their foliage in Autumn, belong also to this family.

23. TERNSTRŒMIACEÆ.

Thea viridis. The Tea-shrub. A flowering shoot; *fl.* a flower (seen from below); *st.* stamens partly adherent to a petal; *p.* pistil; *fr.*—, fruit cut across. —*Camellia japonica.* The Garden Camellia, single and double flowers.

These plants are shrubs or trees, with leathery shining leaves, usually entire and without stipules. The flowers are ordinarily unsymmetrical. The sepals, 5—7, overlap in the bud, the petals are 5, 6, or 9, often united at the base, (in cultivated forms they are much more numerous through transformation of stamens.) The stamens are numerous, free or monadelphous, and adherent to the petals. The fruit is a compound ovary with 2—7 cells, and ordinarily a central column; styles as many as the carpels.

The Ternstrœmiaceæ are found principally in the East of Asia, or in the tropics of the New World. Of the Asiatic kinds the *Camellia japonica* is preeminent among cultivated flowers, while the species of *Thea* scarcely yield in importance to any plants used as food. It appears from Mr. Fortune's inquiries that the difference between black and green tea depends on the mode of preparation, and that both kinds are prepared from both *Thea Bohea* and *T. viridis.*

24. RUTACEÆ.

The Rutaceæ are herbs, shrubs, or trees, with the leaves very frequently marked with transparent glandular dots, with or without stipules; the flowers, generally perfect, have a calyx of 3—5 sepals coherent below; a corolla of 5 petals, sometimes coherent, rarely absent; 5 or 10 stamens, some of which are occasionally abortive. The ovary is formed of 3—5 carpels, more or less united, presenting as many projecting ridges. The carpels are usually seated on a disk. The fruit is either a capsule bursting by valves, or it separates into as many nuts as there are carpels.

This order, taken in its extended sense, includes the Rutaceæ proper together with the Zygophyllaceæ, Diosmeæ, Simarubaceæ, and Xanthoxylaceæ, of some authors. These contain many interesting plants. The common Rue, *Ruta graveolens*, has active properties, as have also the species of *Diosma.* Among the Zygophyllaceæ, the *Guaiacum officinale* or lignum-vitæ tree is remarkable for its hard heavy wood. Of the Simarubaceæ, *Quassia amara,* the Quassia tree, should be mentioned on account of its tonic bitter principle, which exerts a curious intoxicating and poisonous effect on flies. Many of the Rutaceæ are favourite stove-plants.

CALYCIFLORÆ.

25. Anacardiaceæ.
26. Leguminosæ.
27. Rosaceæ.
28. Myrtaceæ.
29. Lecythidaceæ.
30. Onagraceæ.
31. Cucurbitaceæ.
32. Cactaceæ.
33. Grossulariaceæ.
34. Umbelliferæ.
35. Rubiaceæ.
36. Dipsaceæ.
37. Compositæ.
38. Lobeliaceæ.
39. Campanulaceæ.

25. ANACARDIACEÆ.

This is an order mostly consisting of tropical plants, but containing several European kinds of interest, often met with cultivated in our shrubberies. They are all trees or shrubs with alternate leaves destitute of stipules, abounding in resinous or acrid milky juice, turning black in drying. The flowers are small, sometimes imperfect, with 3—5 united sepals, and 3—5 imbricated petals. Stamens, equal in number to the petals and between them, or twice as many, attached to the calyx or to a disk connected with this. Ovary 1-celled, styles usually 3, ovule solitary. Fruit, a nut or a drupe.

These plants are chiefly remarkable for the juice contained in the leaves and shoots, for astringent qualities, and for their edible fruits. Thus of the various species of *Pistacia, P. Lentiscus* and *atlantica* furnish gum Mastic, *P. Terebinthus* Chian turpentine, and another species yields a similar resin in Scinde. *Semecarpus Anacardium* yields a black varnish, and the resin of *Stagmaria verniciflua* is used for Japan lacquer. The species of *Rhus* or Sumach, which have acrid poisonous juices, furnish astringent barks used in tanning. (*R. typhina, glabra, Coriaria.*) The wood of *R. Cotinus* is called Fustic.

Pistacia vera produces the Pistachio-nut, *Anacardium occidentale* the Cashew-nut, of which the fleshy enlarged stalk is edible, while the envelope of the edible nut is acrid. The tropical fruits called Mangoes are produced by *Mangifera indica,* and species of *Spondia* yield the edible fruits called Hog-plums.

26. LEGUMINOSÆ.

Pisum sativum. The garden Pea, a leaf with flower and immature fruit; *fl.* a detached papilionaceous flower; *stp.* stamens and pistils after the petals have been removed; *fr.* | , an immature fruit, opened to show the young seeds.—*Acacia Verek.* The Gum Arabic tree. A leafy shoot bearing a club-shaped inflorescence; *fl.* a detached flower from this inflorescence. *fl.* | , the same opened, and the stamens with part of the petals removed, showing the simple pistil; *fr.* | , a young fruit cut open lengthways; *fr.* outline of a ripe pod; *s.* a seed cut in half.—*Tamarindus indica.* The Tamarind tree; a flowering shoot; *p.* a pistil; *st.* stamens; *fr.* outline of the ripe pod.

This is an exceedingly natural order, the plants of which may be almost always recognised by their fruits, the pods or *legumes* from which they take their name. The Leguminosæ are very abundant, and occur as trees, shrubs, and herbs, of the most varied dimensions. The foliage is composed of alternate leaves, ordinarily compound, with stipules. The flowers have a 5-parted calyx, so placed that an odd tooth is found in the *front* of the flower. The corolla varies in character, and in some cases is imperfect, one or more petals being totally absent; the complete number of free petals is 5. In one division of the family these present what is called the papilionaceous or butterfly form, such as we see in the pea; in the other divisions the corolla is either spreading or more or less regular. The stamens are either 10 in number or indefinitely numerous; in the Papilionaceous forms 9 of the 10 stamens are commonly united together by their filaments, the 10th being free. The germen is single and simple, composed of 1 carpel, or in very rare cases of 2 or more free carpels. In the great body of the family the germen ripens into a legume; in a few genera the substance of the carpel becomes succulent, and the fruit then forms a drupe. In the leguminous forms the pod takes very varied shapes, being straight, curved, spirally curled; flat, cylindrical, or angular; continuous, or constricted at intervals; the last form is distinguished by the name of a *lomentum.* The Leguminosæ are divided into three sections, regarded sometimes as distinct families:—

1. PAPILIONACEÆ. Corolla papilionaceous, the petals overlapping at their margins, the upper one (the standard) outside the rest.

2. CÆSALPINIEÆ. Corolla irregular, spreading, the petals overlapping, the upper one inside the others.

3. MIMOSEÆ. Corolla regular, petals not overlapping at their edges. (This section offers an exception to the calycifloral condition, since the numerous stamens are hypogynous; but they are immediately recognised as belonging to this family by their leguminous fruit.)

1. Many of the *Papilionaceæ* are well known and favourite garden flowers, such as the Sweet Pea (*Lathyrus*), Lupins

(*Lupinus*), Brooms, the Laburnum (*Cytisus*), &c.; and the numerous stove-plants of this group from New Holland. They form an important part of the common agricultural and kitchen-garden plants; for example, the Clovers (*Trifolium*), Beans (*Faba*), Lucerne and Medick (*Medicago*), Peas (*Pisum*), Pigeon peas (*Cajanus*), Scarlet and French beans (*Phaseolus*). These and many other allied kinds are wholesome and nutritious. Other plants of this group possess more active properties, some being poisonous, as the seeds and bark of the Laburnum-tree, the seeds of some species of Lathyrus, the roots of the Scarlet Runner, &c.

A considerable number of exotic Papilionaceæ yield products useful in the arts or medicine; as for example, the Indigo-plants (*Indigofera tinctoria, cærulea,* and other species); the Tragacanth plants (*Astragalus gummifer,* &c.); the Bengal-hemp plant (*Crotalaria juncea*); the liquorice plant (*Glycyrrhiza glabra*); the trees producing the balsams of Peru and of Tolu (*Myrospermun peruiferum* and *toluiferum*); the Kino trees (species of *Pterocarpus*). The Tonka-bean used for scenting snuff is the seed of *Dipteryx odorata. Arachis hypogæa,* the ground nut, so called from pushing its legumes down into the earth, while still attached to the parent plant, (sowing its own seeds as it were,) contains an oil in its seeds, used largely in India. The false Acacia-tree (Cobbett's Locust-tree), the *Robinia Pseudo-acacia,* belongs here; it was introduced from America. The hard red scarlet berries with a black spot, often used as beads, are the seeds of *Abrus precatorius,* and are stated by most authors to be poisonous. The Papilionaceæ are universally distributed.

2. The *Cæsalpinieæ,* of which no representatives are found in our own country, contain many plants of great importance to man, from the medicinal or economical properties of their products, or as timber-trees.

The Carob-tree (*Ceratonia siliqua*), the true Locust, called commonly the St. John's bread-tree, since it is supposed to have furnished the food of the Apostle in the wilderness, has an edible legume, chiefly used in Spain, where it is common for feeding horses. The Tamarind-tree (*Tamarindus indica*), is well known. The dyes yielded by Cæsalpinieæ are important, as logwood (*Hæmatoxylon campechianium*), cam-wood or bar-wood (*Baphia nitida*), Brazil-wood and Pernambuco-wood (species of *Cæsalpinia*); the products of other genera are made use of in tanning. The species of *Cassia* are celebrated for their purgative properties, the Senna-leaves used in medicine being furnished by a number of species of this genus. Many of the trees of this section attain enormous dimensions; some exceeding sixty feet in circumference have been measured in the forests of Brazil. The timber of some West Indian kinds is even imported into England, on account of its toughness and resisting qualities, such as the West Indian Locust (*Hymenæa Courbaril*), the Purple Heart (*Copaifera pubiflora* and *bracteata*,) &c.

3. The *Mimoseæ* are most familiar to us in the genus *Acacia*, the evergreen shrubs bearing hundreds of yellow balls or tassels of blossom, seen in every greenhouse in the spring. They are all exotic. The most remarkable product is the gum Acacia or gum Arabic, yielded in various modifications by the species of this genus in Northern Africa and India: *A. Verek* and *Adansonii* in Senegal, *A. nilotica* and *Seyal*, *A. arabica* and *speciosa* in India; a similar gum is produced by *A. decurrens*, *mollissima* and *affinis* in New Holland. *Vachellia Farnesiana* is another East Indian source. The bark and pods of various species of Acacia are valuable for their astringent qualities, and are used for tanning. The powerfully astringent substance called gum Catechu is an extract obtained by boiling down the heart-wood of *Acacia Catechu*. Rose-wood is the timber of a Brazilian species of *Mimosa*. *Mimosa sensitiva* and *pudica* are the well-known "sensitive" plants.

27. ROSACEÆ.

Amygdalus communis. The Almond-tree. Two sprigs, one with flowers, the other with ripe fruit.—*Pyrus communis*. The Pear-tree. A bunch of flowers; *fl.* |, the calyx (the petals removed) cut through perpendicularly to show the position of the stamens and pistils; *fr.* |, the fruit cut in half, showing the seeds (pips) in its chambers. —*Rosa canina*. The Dog-rose. A flower; *fl.* |, a flower cut open perpendicularly; *fr.* a ripe fruit with a little piece cut off the side to show the achenes within. — *Fragaria vesca.* The Wood-strawberry. A flower and leaf; *fl.* |, a flower cut open perpendicularly; *fr.* a ripe fruit.

The Rosaceæ occur as trees, shrubs, and herbs, with alternate leaves, usually provided with stipules. The flowers are regular, and in most cases perfect, but sometimes unisexual, devoid of a corolla. The calyx has 4 or 5 teeth, and occasionally (as in *Potentilla*) intermediate teeth outside them, forming as it were an outer calyx; the odd tooth of the calyx is here at the back, the reverse of what occurs in Leguminosæ. Petals mostly 5, sometimes 4, or even wanting. Stamens definite or indefinite in number; within them occurs a kind of disk sometimes lining the cup of the calyx (*Rosa*), or forming a kind of ring at the throat (*Fragaria*, &c.) Ovaries either solitary, several or numerous, simple, one-celled, with one or a few seeds. Fruit very variable, a drupe (Cherry, Plum, &c.), a group of minute drupes or acini on a common receptacle (Raspberry, Blackberry), a fleshily enlarged receptacle bearing dry achenes (Strawberry), a dry receptacle with dry achenes (*Potentilla*, *Geum*); or a fleshily thickened and enlarged calyx-tube enclosing numerous dry achenes (*Rosa*), or a circle of carpels converted into stony kernels (Medlar), or into parchment-like cells combined together and forming a "core" (Apple, Pear); or a dry calyx-tube enclosing one dry achene (*Sanguisorbeæ*).

The Rosaceæ are very generally diffused, and are remarkable for the beauty of the flowers, and the grateful qualities of the fruits of many kinds. The family is subdivided into a number of sections, some of which, like those of the Leguminosæ, are regarded as separate families by particular authors.

1. AMYGDALEÆ. Carpel solitary, style terminal, fruit a drupe.

2. POMACEÆ. Carpels 1 to 5, adherent to the calyx by their backs.

3. ROSEÆ. Carpels 1 or many, free from the calyx, and almost or quite from each other; style lateral.

4. SANGUISORBEÆ. Carpel solitary, corolla wanting, fruit with the hardened calyx-tube forming a false pericarp around the dry single achene.

1. The *Amygdaleæ* are mostly found in temperate climates and are familiar to us in the Almond-tree (*Amygdalus communis*), and the Peach (*A. persica*), Nectarine (*A. lævis*), the various species of *Cerasus,* namely, the edible Cherries: Bigarreaux and most table cherries (*Cerasus Duracina*), Black Eagle, &c. (*C. Juliana*), and Morellos, Kentish cherries, &c. (*C. caproniana*). The Cherry-laurel, or common "Laurel" of our shrubberies (*C. Lauro-cerasus*), the Portugal Laurel (*C. lusitanicus*), &c.; the species of *Prunus,* such as the various Plums, Green-gages (varieties of *P. domestica*), Bullace (*P. insititia*), the Apricot (*P. Armeniaca*), and the Sloe (*P. spinosa*). These plants are not merely remarkable for the delicious character of the pulpy fruits of most; many of them contain a considerable quantity of a substance called Amygdaline, which, when it escapes from its reservoirs and becomes mixed with the other juices, is converted into prussic acid. This is especially remarkable in the kernels of the bitter variety of the Almond, and of the Cherry, Plum, &c., in the leaves, flowers, and other parts of the Cherry-laurel and other kinds. These plants mostly contain also a gummy juice, which exudes and hardens on the surface of the branches, and is often used instead of the gum of the Acacias. The seed of the sweet variety of the Almond affords an example of the existence of the fixed oil without the dangerous substance amygdaline. Hence, common expressed almond-oil is destitute of the characteristic odour and taste of the essential oil of bitter almonds, and is harmless.

2. The *Pomaceæ* are likewise chiefly important on account of their fruits. The many varieties of Apple (*Pyrus Malus*) and Pear (*Pyrus communis*), together with the Quince (*Cydonia vulgaris*), Medlar (*Mespilus germanica*), Siberian Crabs (*Pyrus prunifolia* and *baccata*), &c. are so well known as merely to require naming. The Mountain Ash (*Pyrus Aucuparia*) is a very ornamental tree; many parts of it con-

tain prussic acid, as is the case with the seeds of most of the Pomeæ. Many species of *Cratægus* (Hawthorns), *Carboneaster, Mespilus, Pyrus,* &c. are ornamental shrubs or small trees; *Pyrus japonica* is a well-known favourite in gardens. The hard wood of the pear is sometimes used for the same purposes as box-wood.

3. The *Roseæ* contain important fruits, such as the Strawberries (*Fragraria vesca, elatior,* &c.), Raspberry (*Rubus Idæus*), and the less important Blackberries (*Rubus fruticosus,* &c.), Hips (*Rosa canina*), &c. The petals of the Roses (*Rosa*) yield the essential oil called Otto of Roses, on which their delicious fragrance depends, and their petals, like this part of various other Roseæ, possess astringent properties.

4. The *Sanguisorbeæ* are plants of little importance, herbs or small shrubs, mostly characterised by astringent properties.

28. MYRTACEÆ.

Myrtus communis. The common Myrtle. A flowering shoot; *fl.* |, a flower cut open perpendicularly. — *Caryophyllus aromaticus.* The Spice Clove. A flowering shoot; *b.* |, an unopened bud (a "clove") cut through perpendicularly; *fl.* an open flower.

This order, taking its name from the genus *Myrtus,* to which the common Myrtle belongs, consists of trees and shrubs with entire leaves, mostly opposite, devoid of stipules and covered with transparent dots. The leaves also frequently exhibit a vein running round the edge just inside the margin. The calyx is adherent to the ovary, with 4 or 5 teeth. The petals are 4 or 5, or altogether absent; the stamens usually numerous, with elongated filaments. The compound ovary is surmounted by a simple style. This is a berry in one division of the family (*Myrteæ*); in the other (*Leptospermeæ*) a capsule.

The Myrtaceæ are tropical or sub-tropical plants, mostly possessing aromatic properties, and yielding spices and essential oils. The fruits of many are highly prized. Among the aromatic kinds are the *Caryophyllus aromaticus,* the unopened flower-buds of which form the cloves used as spice. *Eugenia*

Pimento and *acris* yield the dried fruit called Allspice. The leaves of *Melaleuca minor* furnish Cajeput oil. The fruits of various species of *Eugenia* are called Rose-apples, and those of *Psidium* Guavas. The Pomegranate-tree (*Punica Granatum*) is usually included here.

The species of *Eucalyptus* are the gum-trees of Australia, called also "Stringy-barks," from their bark separating in strips. They contain tannin. Some of them attain enormous size, as much as 200 feet in height and 15 feet in diameter.

29. LECYTHIDACEÆ.

This is a small order allied to the Myrtaceæ, remarkable for the peculiar fruit, which is woody, and in some cases opens at the top when ripe, by the separation of a kind of lid, whence the plants are called Monkey-pot trees. *Bertholletia excelsa,* a South American tree, growing to a height of 120 feet, furnishes Brazil nuts.

30. ONAGRACEÆ.

The plants included in this order are herbs or small shrubs, principally natives of the temperate parts of America. Many are favourites in our gardens, such as the Fuchsias, Œnotheras, Clarkias and other genera.

31. CUCURBITACEÆ.

Cucumis melo. The Melon-plant. A shoot with flowers; ♂, a staminate or barren flower; ***fl*** ♂ |, the same cut open perpendicularly; ***fl*** ♀, a pistillate, or fertile flower; ***fl*** ♀ |, the same cut open perpendicularly; *st.* a stamen with convoluted anther. — *Lagenaria vulgaris.* The Bottle Gourd. Ripe fruit.— *Cucumis sativus.* The Cucumber. Ripe fruit.

The plants belonging to this order have a very characteristic appearance, being climbing herbaceous plants with a tendril growing in the place of a stipule, at the side of the alternate palmate-veined leaves. The flowers are unisexual. The calyx has 5 teeth, and in the female flowers its tube is adherent to the ovary. The petals are 4 or 5 in number, usually coherent; stamens ordinarily 5, distinct or connected together, with large and curiously convoluted anthers.

Ovary inferior, 3-celled, with 3 retroverted placentas, ripening mostly into a large pulpy fruit with a more or less firm rind (a *pepo*), sometimes into a round succulent berry.

The Cucurbitaceæ contain an abundant watery juice which is more or less endowed with purgative properties, sometimes scarcely noticeable, so that their fruits are wholesome, sometimes very active, when the extract becomes a powerful medicinal agent. Of the edible kinds, are the fruits of the Cucumber (*Cucumis sativus*), the Melons (*Cucumis melo* and *utilissimus*), the Water-melon (*Cucurbita Citrullus*), the Red Gourd (*Cucurbita maxima*), the White Gourd (*Cucurbita Pepo*), and others.

Citrullus Colocynthis, on the contrary, has strongly purgative fruits, yielding the Colocynth of the druggists, and the violent substance of this kind, called Elaterium, is obtained from the juice of *Ecbalium agreste*, or *purgans*. The White Bryony, our only native example of this family, forms a large root, which has purgative properties, and it is further remarkable for bearing a small succulent berry.

The hard rinds of the ripe fruits of the gourds are used for containing liquids. The Bottle gourd is an example of a curious form.

32. CACTACEÆ.

Cactus Opuntia. The Prickly-fig Cactus. *fl.* a flower; *fl* |, the same (enlarged) cut open perpendicularly; *fr.* the fruit. The intermediate figure is a portion of the flat stem of the plant on a smaller scale.—*Melocactus communis.* A Globe Cactus. The entire plant with roots.

The members of this remarkable order are mostly distinguishable by the remarkable form of their stems, which ordinarily present themselves as globular, columnar, snake-like, or somewhat leaf-like succulent masses, of a green colour, studded with tufts of spines, which represent the metamorphosed scales of an undeveloped leaf-bud. In *Pereskia* leaves are developed. The flowers of Cactaceæ, mostly showy, have a calyx composed of numerous combined sepals, the tube adhering to the ovary. Petals and stamens indefinitely numerous, the latter with long filaments. Ovary 1-celled with parietal placentas, ripening into a succulent berry, often subacid and agreeable, but mostly insipid.

The Cactaceæ are chiefly noticeable on account of their peculiar organization. The *Cereus grandiflorus, nycticalus,* and other species are remarkable for opening their flowers at night and closing them in the morning.

Opuntia coccinellifera is the plant upon which the Cochineal insect feeds.

33. GROSSULARIACEÆ.

This is a small order of plants yielding wholesome fruits, consisting of shrubs with alternate palmately divided leaves, and often spiny branches. The flowers are very small, but elegant, on account of their regularity even when inconspicuous; but sometimes sufficiently showy to be favourites in cultivation. The calyx has the tube adherent; its teeth, like the petals and stamens, are 5 in number; the ovary is 1-celled, with 2 parietal placentas, which, with the internal parts of the ovary, ripen into an acid pulp enclosing the seeds, forming a berry crowned by the withered remains of the teeth of the calyx.

The black, red, and white Currants of our gardens, with the Gooseberry, are native species of *Ribes;* other species of the same genus are cultivated for their flowers, e. g. *R. aureum, sanguineum,* &c. These are derived from North America and New Holland.

34. UMBELLIFERÆ.

Conium maculatum. Hemlock. A flowering sprig; *fr.* a ripe fruit; *fr.*—, the same cut across; *fr.* |, half the fruit, cut perpendicularly, to show the seed. —*Œnanthe crocata.* Water-dropwort. Inflorescence and leaf; *fr.* a fruit.—*Fœniculum vulgare.* Common Fennel. A flowering sprig; *fl.* a separate flower; *fl.* |, the same cut perpendicularly; *fr.*—, a fruit cut across; fr. ripe fruit.

This is a very natural order of plants, characterised, in the great majority of cases, by the arrangement of the flowers in umbels, often surrounded at the base by a circle of bracts forming an involucre. The plants are herbaceous, frequently with a hollow stem, bearing alternate leaves generally very much divided, and sheathing at the base. The calyx adheres to the ovary, and has when perfect 5 teeth, but these are often obsolete, or represented by a thickened ring. Petals 5, often notched at the end, inflexed, frequently unequal in the outer flowers of the umbels. Stamens 5, alternate with the petals, and adherent at the base, like the petals, to a fleshy disk which sumounts the ovary; styles, 2. Ovary composed of 2 one-seeded carpels closely united when young, ripening into two independent dry indehiscent halves, which separate from each other and from a central prolongation of the receptacle, which splits and forms a fork, at the ends of which the fruits are suspended. The fruits exhibit on their outer face ridges of various kinds, between which are streaks called vittæ, formed of tissue containing essential oils.

The Umbelliferæ are natives of temperate climates, and are found almost exclusively in elevated situations in the tropics. Their properties are varied, even in the same plants: many are poisonous; others remarkable for their aromatic properties; a portion of them are valuable as wholesome articles of food, while those found in the warmer regions often contain a gum-resin of stimulating character. Many which are acrid when wild, lose much of their characteristic smell and flavour when cultivated, as is the case with Celery and other kinds commonly grown in gardens; in this mild condition they are often characterised by a great development of the succulent tissues; this occurs to a great extent in the roots of the Carrot and Parsnep.

The more important plants of this family may be enumerated under sections formed according to their properties.

Species somewhat acrid, when wild—wholesome and agreeable when cultivated: Carrot (*Daucus Carota*), Parsnep (*Pastinaca sativa*), Celery (*Apium graveolens*), Fennel (*Fœniculum vulgare*), Parsley (*Petroselinum sativum*).

Species with a poisonous, acrid-narcotic juice: Hemlock (*Conium maculatum*), Water Hemlock (*Cicuta virosa*), Hemlock Dropwort (*Œnanthe crocata,* and *Œ. Phellandrium*), Fool's Parsley (*Æthusa Cynapium*).

Species with an aromatic essential oil, especially in the fruits (commonly called *seeds*): Caraway (*Carum Carui*), Coriander (*Coriandrum sativum*), Cummin (*Cuminum Cyminum*), Anise (*Pimpinella Anisum*), Dill (*Anethum graveolens*). Celery, Fennel, the Carrot, and others of the first section, possess the same character.

Species with a gum-resinous juice, often with a fœtid odour: Asafœtida (*Narthex Asafœtida*), native of Persia and Affghanistan. *Ferula persica* yields a similar substance. *Dorema ammoniacum* yields gum Ammoniacum; *Pastinaca Opopanax,* the gum Opopanax; *Galbanum officinale* and *Opoidia galbanifera* have been supposed to yield gum Galbanum, but this is uncertain.

35. RUBIACEÆ.

Coffea arabica. The Coffee-tree. A flowering shoot; *fl.* a flower; *fr.* —, a berry cut across; *s.* one of the seeds of this (the "coffee-berry" of the shops) cut across, with a little piece cut away below to show the embryo.—*Rubia tinctorum.* Madder. Part of a shoot, bearing flowers; *fl.* a single flower; *fl.* |, the same cut perpendicularly.

Taking the *Cinchoneæ* and *Stellatæ* together as one family, the Rubiaceæ consists of herbs, or shrubs, or trees, with opposite, or whorled stipulate leaves, (apparently exstipulate in Stellatæ, from the stipules being developed like the leaves.) The inflorescence is cymose; the calyx adherent, toothed or entire, corolla regular, stamens adherent to the petals, which are inserted on the calyx. Ovary 2-celled, style single. Fruit consisting of 2 separating nuts, a dry indehiscent capsule, or a succulent berry.

The Stellatæ are natives of temperate climates, the Cinchoneæ chiefly of the tropics. The properties of this large family are very varied. Peruvian Bark, containing Quinine and other allied principles, is derived from species of *Cinchona,* growing on the slopes of the Andes. *Cephaelis Ipecacuanhæ,* another South American plant, furnishes Ipecacuanha root, well known for its emetic properties. Coffee consists of the seeds of *Coffæa Arabica,* 2 of which enclosed in a firm endocarp are contained in a pulpy berry. Other plants of the family have qualities allied to those of *Cinchona* and *Cephaelis,* and yield spurious articles sold under the same names. A large number of the Cinchoneæ have beautiful, many very fragrant flowers; for example, *Gardenia,* commonly called Cape Jasmine, *Ixora, Rondeletia,* and other genera commonly cultivated in our stoves. Among the Stellatæ, the Madder-plant, *Rubia tinctorum,* is one of the most important. *Asperula odorata,* common Woodruff, is remarkable for its fragrance when dried.

36. DIPSACEÆ.

This small order, to which belongs the Teazle plant (*Dipsacus fullonum*), and the garden Scabious (species of *Scabiosa*) is allied to the Compositæ in the character of the inflorescence, which consists of capitules with an involucre, and in the pappus-like calyx; but the calyx of each floret has a separate involucel, and there are only 4 stamens, the anthers of which do not cohere.

37. COMPOSITÆ.

Anthemis nobilis. The Chamomile plant. Flowering sprig; *fl.d.* floret of the disk; *fl.r.* floret of the ray. — *Centaurea Cyanus.* Corn Blue-bottle. A blossom; *fl.* a detached central floret; *st.* stamens removed from ditto; *p.* pistil from the centre of ditto; *fr.* ripe fruit with crown of pappus. — *Leontodon Taraxacum.* The Dandelion. Flower, bud, and radical leaf; *fr.* receptacle with the ripe fruits dropping off. — *Senecio vulgaris.* Groundsel. A sprig with flower and fruit; *fl.d.* floret of the disk; *fl.r.* floret of the ray.

The Compositæ form a very extensive order, composed of herbs and shrubs, with leaves alternate or opposite, without stipules, and with the flowers (singly of small size and called *florets*) collected into a closely packed head, inserted on an enlarged common receptacle, and surrounded by a common involucre of more or less numerous bracts (this is called a *capitulum* or *compound flower*). The separate florets are often furnished with small single bracteoles, in the form of scales or reduced to hairs. The florets differ in character; they may be either perfect, unisexual or neuter, regular or irregular, The calyx is adherent by its tube to the ovary, and its teeth are represented by a circle of scales, spines, feathers, or hairs (called *pappus*), or are altogether wanting. The corolla has the 5 petals united, and when regular the corolla presents 5 equal spreading teeth at the top of a long tube (*tubular florets*); when irregular, the petals sometimes cohere altogether into a tube at the base, and then turn off suddenly to the side, united into a flat strap-like piece, which has more or less distinct teeth at its end (*ligulate florets*), or it is bi-labiate. The 5 stamens have free filaments, but the anthers cohere and form a tube round the long single style which terminates in 2 stigmas. Ovary inferior, one-seeded, ripening into an indehiscent seed-like body (*cypsela*), often crowned at the summit by the persistent pappus, which is sometimes supported on an elongated stalk or *beak*.

The arrangement of the florets on the capitules affords ground for subdividing this large order. Since the labiate-flowered kind are only found in a few peculiar American forms, the division of Jussieu will suffice here.

1. CORYMBIFERÆ. Florets all tubular, perfect, or with the outer containing only pistils; or with a *disk* or eye composed of tubular perfect florets, and a *ray* of ligulate pistillate florets; styles not thickened below the stigmas.

2. CYNAROCEPHALÆ. Florets all tubular, and perfect, or the outer ones neuter; style thickened below the stigmas.

3. CICHORACEÆ. Florets all ligulate.

1. The plants of the first division are usually bitter and aromatic, often containing a volatile oil. Of these may be mentioned the Chamomile (*Anthemis nobilis*), Wormwood (*Artemisia Absinthium*, other species of which have similar characters). *Arnica montana* is an acrid stimulant. The common Sun-flower (*Helianthus annuus*) contains much oil in its seeds; *H. tuberosus*, the Girasole or "Jerusalem" artichoke, furnishes edible tubers. The garden Dahlia (*D. variabilis*) belongs here; and a large number of our common weeds, such as Groundsel (*Senecio vulgaris*), the Daisy (*Bellis perennis*), &c.

2. The *Cynarocephalæ* have usually bitter juices; some are edible, as the Artichoke (*Cynara Scolymus*) and Cardoon (*C. Carduncului*). The thistles are species of *Carduus*, *Onopordum*, &c. Knap-weed (*Centaurea nigra*) and the Blue-bottle (*C. cyanea*), are common weeds of this division. The Safflower (*Carthamus tinctorius*) yields a red dye.

3. The *Cichoraceæ* contain a milky juice, which possesses more or less of tonic, diuretic, and narcotic properties. The narcotic property is found in one of the wild Lettuces (*Lactuca virosa*); in the common lettuce (*L. sativa*), this juice becomes almost powerless in cultivation. The juice of the Dandelion (*Leontodon Taraxacum*) is employed as a diuretic. *Cichorium Intybus* (Chicory) is cultivated for the sake of the roots, used to adulterate coffee. *C. Endivia* is the salad-plant Endive, which is obtained succulent and white in cultivation by growing it in a rich soil with little access of light.

38. LOBELIACEÆ.

These are plants of analogous habits to the Campanulaceæ as to dimensions, foliage, &c.; the calyx has also an adherent tube, and a five-toothed limb. The corolla, however, is irregular, the 5 teeth of the limb being usually deeply divided into two lips. The most remarkable character lies in the anthers, which are coherent round the style, as in the florets of the Compositæ. Fruit capsular, 1 or more celled, opening at the apex.

The Lobeliaceæ, which are mostly natives of tropical or sub-tropical regions, have often very showy flowers, scarlet or bright blue, hence have been great favourites in gardens. Many *Lobelias* are hardy herbaceous plants, others do not bear our winters. *Siphocampylus* requires a stove. The milky juice of these plants is far more noxious than that of the Campanulaceæ, being a powerful acrid-narcotic poison in some kinds. Such is the case with *L. inflata*, a North American plant, and other species of *Lobelia* share this property. Some species of *Tupa* are said to be very poisonous.

39. CAMPANULACEÆ.

Campanula Rapunculus. The Rampion. A sprig with flowers; *fl.* | , a flower cut open perpendicularly. — *Campanula Medium.* The Canterbury Bell. A flowering sprig; *stp.* the pistil with one stamen left, after the removal of all the rest of the outer parts of the flower.

This order consists of herbs or small shrubs, with a milky juice. The leaves are alternate, without stipules, and the usually bell-shaped flowers are blue or white, and often very showy. The tube of the calyx adheres to the ovary, its limb is 5-parted; the tubular or bell-shaped corolla has also 5 teeth, and withers up, and does not fall off when the flower fades. Stamens 5, distinct. Style hairy. Fruit a dry capsule, 2 to 5 chambered, opened by orifices at the sides or bottom or valves at the top, containing numerous seeds on axile placentas.

These plants are chiefly remarkable on account of the beauty of the flowers of many kinds, such as the Canterbury bell (*Campanula Medium*), and the wild Hare-bell (*C. rotundifolia*). In most of them the milky juice is acrid, but some kinds are edible, as the Rampion (*C. Rapunculus*). An African genus, *Cyphia*, produces farinaceous tubers. Most of the Campanulaceæ, however, belong to the northern parts of both the old and new world.

COROLLIFLORÆ.

40. Ericaceæ.
41. Vacciniaceæ.
42. Apocynaceæ.
43. Loganiaceæ.
44. Asclepiadaceæ.
45. Gentianaceæ.
46. Bignoniaceæ.
47. Gesneraceæ.
48. Crescentiaceæ.
49. Convolvulaceæ.
50. Boraginaceæ.
51. Solanaceæ.
52. Scrophulariaceæ.
53. Orobanchaceæ.
54. Labiatæ.
55. Verbenaceæ.
56. Acanthaceæ.
57. Primulaceæ.
58. Plumbaginaceæ.
59. Plantaginaceæ.

40. ERICACEÆ.

Erica Tetralix. Cross-leaved Heath. A flowering sprig; *p.* pistil; *st.* stamen; *fl.* a flower; *stp.* stamens and pistils after the corolla has been removed. —*Rhododendron ciliatum.* Fringed Rhododendron. A branch with flowers.

The Heath order consists exclusively of shrubs, of large or small size, with evergreen leaves of rigid texture, mostly narrow, undivided, and standing in circles or in pairs, without stipules. The free calyx has a 4 or 5-toothed limb, which is persistent. The tubular or campanulate corolla is more or less deeply 4 or 5-cleft above, and includes 8 or 16 or 10 or 20 stamens, according to the number of segments in the corolla; these stamens are really hypogynous, *i.e.* inserted in the receptacle, but in all the other characters these plants agree with the Corolliforæ. The anthers have tails, and open by 2 pores at the summit. The ovary is surrounded by a *disk* or by scales, and it ripens either into a capsule or a berry with numerous seeds.

The plants of the large genus *Erica,* the true Heaths, are greatly valued for the beauty of their flowers, and they appear to have no active properties. The *Rhododendra,* the *Azaleæ, Kalmiæ,* still more esteemed for their often magnificent blossom, appear to be poisonous, while the berries of *Arbutus* are merely astringent.

Arbutus Unedo is the celebrated Strawberry-tree, not found wild in Britain anywhere but about Killarney. The *Rhododendra* are mostly Alpine plants; the North American kinds, with the Kalmias, &c., are bog-plants.

The Heaths are most numerous at the Cape of Good Hope. Comparatively few grow in Europe; in Britain only two true Heaths, *E. tetralix* and *E. cinerea,* together with the Heather (*Calluna vulgaris*) are commonly met with. Three other *Ericæ* are found in a few localities in Cornwall and the West of Ireland.

41. VACCINIACEÆ.

This order of plants approaches very closely to the Ericaceæ, with which indeed they are ordinarily combined. It consists of shrubs, with alternate leathery leaves of small size, without stipules. The distinction from the Ericaceæ proper lies in the adherence of the tube of the calyx to the ovary. The corolla is 4—6-lobed. The anthers have appendages or tails, and open by two pores at the summit. Fruit, a berry.

These plants are mostly low shrubs, growing in mountain bogs in temperate climates, and bearing edible berries of a sourish flavour, much esteemed by some palates.

Oxycoccus palustris is the Cranberry-shrub, which grows on bogs throughout Europe; *O. macrocarpa,* a very similar plant, yields the American Cranberry. The Bilberry is the fruit of *Vaccinium Myrtillus,* the Red Whortleberry is that of *V. Vitis Idæa,* and the Black Whortleberry of *V. uliginosum;* all common in the north, and on mountains throughout Europe.

42. APOCYNACEÆ.

Vinca minor. Lesser Periwinkle. A sprig with flower; *fl.* | , a flower cut open perpendicularly; *st.* stamen; *p.* pistil; *fr.* ripe fruit. — *Nerium Oleander.* The Oleander or Rose-bay. A flowering shoot.

These plants are trees or shrubs, nearly allied to the Asclepiadaceæ, from which they differ in having the corolla *twisted* in the bud, the filaments free, with the pollen pulverulent, and a rounded drum-like glandular stigma.

Very few are natives of temperate climates; those of the tropics are frequently very poisonous. Many have a milky juice, which is sufficiently abundant in some to be a source of Caoutchouc for commerce. Many have very beautiful flowers.

The common Periwinkles (*Vinca major* and *minor*) are the only native representatives, but our stoves and conservatories are ornamented by many showy kinds, such as the Oleander (*Nerium Oleander, odorum,* &c.), the species of *Echites, Allamanda, Dipladenia,* &c.

Among the kinds yielding milky juice is the Cow-tree of Demerara (*Tabernæmontana utilis*), the milky sap of which is innoxious and nutritious. *Urceola elastica* in the East Indies, *Vahea gummifera* and *madagascarensis* in Madagascar, *Collophora utilis* and *Cameraria latifolia* in South America, are important sources of Indian rubber.

Wrightia tinctoria is an East Indian plant, yielding a blue dye like Indigo. *Tanghinia venenata* is the source of the poison-nut formerly used in the well-known ordeal of the Madagascarenes. *Carissa Carandas*, and other East Indian plants of this family, yield harmless, pleasant acid fruits.

43. LOGANIACEÆ.

An order of plants chiefly tropical, consisting of trees, shrubs, or herbs, nearly allied in many respects to the Apocynaceæ. They have opposite entire leaves, with stipules; a 4-or 5-parted calyx, a 4-, 5-, or 10-toothed corolla, and a variable number of stamens. The most striking point of distinction is the absence of the glandular structure in the stigma.

The Loganiaceæ are violent poisons, as might be judged from the fact that they include plants yielding Strychnia. This occurs in the seeds of *Strychnos nux Vomica,* an East Indian plant. *S. Tieuté* yields the Java Upas Tieuté poison, and *S. toxifera* the Wurali poison of Demerara. The seeds called St. Ignatius's beans are those of *Ignatia amara;* they are poisonous in large doses.

44. ASCLEPIADACEÆ.

Hoya Cumingiana. Cuming's Hoya. Part of a branch with flowers.—*Asclepias.* Silk-weed. *fl.* a flower; *stp.* stamens and pistils; *st.* a stamen; *s.* a seed with a crown of silky hairs.—*Stapelia Asterias.* Starfish Stapelia. In front, a flower; behind, an entire plant reduced.

Herbs or shrubs, often of climbing habit, with undivided leaves, usually placed in pairs, with cilia between the bases of the leaf-stalks. Calyx and corolla 5-parted; stamens 5; filaments usually coherent, with the pollen in waxy masses, connected together in pairs, attached to glands at the corners of the 5-angled stigma which surmounts and conjoins the 2 styles. Fruit, 2 follicles or pods opening down one side, filled with seeds bearing a silky crown.

The Asclepiadaceæ are often called Milk-weeds, from the milky juice they contain, in which Caoutchouc exists; they have active properties of various, often poisonous nature. A few are found in temperate climates, but most are tropical plants.

Several species of *Asclepias* grow in North America, some of which are called Wild Cotton, on account of their feathered seeds. *Asclepias syriaca, tenuissimum,* and others, have a fibre in their stems, capable of being spun. Many of the tropical species have curious or beautiful flowers. The Hoyas are climbing evergreen (stove) plants, with fleshy leaves, with roundish heads of wax-like, often very handsome, flowers. The *Stapeliæ* are remarkable, fleshy plants, with very large sessile flowers, curiously marked and veined, of a dull lurid colour and with a fetid odour. The leaves of *Dischidia Rafflesia* afford an example of " pitcher " leaves.

45. GENTIANACEÆ.

Gentiana acaulis. Gentianella. A single plant in flower; *fl.* |, a flower cut open perpendicularly.—*Erythræa Centaurium.* Common Centaury. The top of a flowering stem; *fl.*, a flower; *fl.* +, a flower laid open, *p.* a pistil.

This order is almost exclusively composed of herbs, mostly with attractive flowers. The leaves are opposite, undivided, and destitute of stipules. The calyx and corolla are both persistent after flowering; the latter being often plaited, and having sometimes a fringed limb. The stamens (5) alternate with the segments of the corolla. The ovary is composed of 2 carpels, placed right and left, with 2 parietal placentas, standing fore and aft in the flower; style 1, stigmas 2; fruit, a capsule or a berry.

These plants occur in all climates, and all over the world; some on the highest Alps, others on the plains of the tropics. They have, generally, bitter, tonic properties, but are chiefly noticeable on account of their flowers.

The Gentians are almost all perennial herbs, many alpine and very small, with handsome blue flowers. *G. lutea,* the yellow Gentian of the European mountains, yields the bitter root used in medicine. *Lisianthus* is a handsome stove genus. *Sabbatia,* a North American genus, has crimson flowers;

Chlora perfoliata, and the aquatic *Villarsia nymphæoides*, are native plants with brilliant yellow flowers. In *Erythræa* they are of a delicate rose.

46. BIGNONIACEÆ

are trees, or climbing or twining shrubs. Natives of America. Some are well known in cultivation here, such as certain species of *Bignonia* and *Catalpa*, which bear our climate, also *Eccremocarpus*, a small climbing plant, which is generally killed by the frost in winter.

47. GESNERACEÆ

are chiefly tropical plants, many of which are favourite objects of cultivation in our stoves; such as species of *Gesnera*, *Achimenes*, *Gloxinia*. The succulent fruits are sometimes edible.

48. CRESCENTIACEÆ

are remarkable plants, allied to the Bignoniaceæ; with the flowers growing upon short shoots coming out from the old trunks and branches. They are tropical plants. *Crescentia Cujeta*, the Calabash-tree, owes its name to the bottles made of the hard shell of its gourd-shaped fruit. Sometimes these grow to two feet in diameter, and they are used in Africa as floats (like empty barrels) in crossing rivers.

49. CONVOLVULACEÆ.

Convolvulus sepium. Hedge Convolvulus. A sprig with flowers, bud, and leaf; *fl.* |, a flower cut open perpendicularly. — *Cuscuta Epithymum.* Lesser Dodder. Portion of a stem, in flower; *fl.* |, a flower cut open perpendicularly; *fl.* +, a corolla slit and laid open.

The plants of this order may usually be distinguished by their twining habit. They are shrubs or herbs, with a milky juice, alternate leaves without stipules, and regular flowers. Calyx 5-parted, overlapping in the bud, persistent. Corolla plaited and twisted in the bud. Stamens 5, alternate with the (often scarcely marked) lobes of the corolla. Ovary from 2- to 4-celled, 1—2 seeds in each cell; styles united, stigma sometimes distinct.

The Convolvulaceæ are remarkable, not only for their ordinarily beautiful blossoms and twining habit of growth, but for active purgative properties. Of the latter, the most important examples are the Jalap plant (*Exogonium* or *Ipomæa Purga,* from Mexico), the Scammony plant (*Convolvulus Scammonia*). The root of the wild white hedge Convolvulus (*C. sepium*) has similar properties. *Convolvulus Batatas* (or *Batatas edulis*), on the contrary, has an edible, highly nutritious tuber, and is called the Sweet Potato.

Many species of Ipomæa and Convolvulus are familiar garden plants. *Convolvulus,* or *Calystegia purpurea,* is the "major" Convolvulus, *Conv. tricolor,* the "minor" Convolvulus of our gardens.

The Cuscuteæ are commonly separated from the Convolvulaceæ as a distinct family. They are leafless, twining parasites, consisting of reddish or purplish thread-like stems, coiled round herbaceous or shrubby plants, and bearing tufts of flowers. The *Cuscutæ* or Dodders of this country are pests in clover and flax fields. They are said to have purgative properties.

50. BORAGINACEÆ.

This order consists of herbs or shrubs, with round stems bearing alternate leaves, usually rough or hispid, and flowers in spirally uncoiling cymes. The calyx and corolla are regular, and usually 5-cleft, often with a crown of scales in the throat of the latter. Stamens 5, alternate with the segments of the corolla. Ovary 4-lobed, with a central single style. Fruit of 1 or 2 minute nuts, contained in the persistent calyx.

These plants are mostly harmless; some have handsome flowers, others furnish dyes.

Among the most interesting plants of the family is the Forget-me-not (*Myosotis palustris*). *Anchusa tinctoria* yields Alkanet root.

51. SOLANACEÆ.

Capsicum annuum. Capsicum plant. A shoot with flower and young fruit; *fl.* +, a flower laid open; *fr.* a calyx containing the pistil after the corolla has been removed. — *Datura Stramonium.* Thorn-apple. A sprig with a flower and leaves; *fr.* a ripe fruit bursting. — *Solanum Dulcamara.* Bitter-sweet, or Woody Nightshade. A sprig with flowers; *fr.* a bunch of young berries. — *Nicotiana Tabacum.* The Tobacco plant. A flowering shoot; *fr.* the ripe fruit bursting. — *Atropa Belladonna.* Deadly Nightshade. A shoot with flowers above and a berry below.

This order of plants is remarkable from the majority possessing more or less active poisonous properties, while others furnish innocuous and universally consumed articles of food. They are herbs or shrubs, with alternate leaves, the flowers growing in cymes, arising usually a little above the axils of the leaves. The calyx and corolla have the limb usually 5-, rarely 4-parted; the corollas are mostly regular, sometimes irregular, but with the lobes nearly equal. Stamens 5; in rare cases, one of them is barren. Ovary usually 2-celled, occasionally 4- or 5-celled; style simple, stigma 2-lobed or club-shaped. The fruit is mostly a 2-celled, occasionally 4- or 5-celled capsule, or a succulent berry.

Some of these plants (*Solaneæ,* those with the corolla valvate or folded in the bud) are not marked by the violent narcotic properties found in the others (*Atropeæ,* those with an imbricated corolla).

They occur in all climates, and especially abound in the warmer.

The most remarkable of the *Solaneæ* are the species of *Solanum,* of which *S. tuberosum* is the Potato-plant, originally a native of South America. *S. nigrum* is a roadside weed, and *S. Dulcamara,* Bitter-sweet, a hedge-climber, both very common in Britain. The leaves of all these have narcotic properties. *S. Melongena* is the Egg-apple; the large purple kind is eaten in the South of Europe, and other species of *Solanum* yield edible fruit. The Tomato, or Love-apple, is the fruit of *Lycopersicum esculentum,* a plant allied to the *Solana; Capsicum annuum* yields the common Capsicum used for pickling; the fruits of *C. frutescens, baccatum,* and *minimum,* are called Chilies. A species of *Physalis,* of which the species *Alkekengi,* or Winter-cherry, is well known in gardens, yields an edible fruit in Peru.

The *Atropeæ* are much more active. *Atropa Belladonna,* Deadly Nightshade, is one of our most poisonous native plants. Henbane (*Hyoscyamus niger*), remarkable for its viscid foliage, is a powerful sedative. *Datura Stramonium,* the Thorn-apple, is another poisonous plant, mostly found in old gardens as a weed; this and other foreign species are used as remedies for asthma, smoked like tobacco. The Tobacco-plant (*Nicotiana tabacum*), is an American plant of this family, now cultivated all over the world. *N. persica* and *N. rustica* are likewise grown in the East. The Mandrake, a plant renowned in ancient times for its supposed magical virtues, is *Mandragora officinalis.* This has a forked tap-root, which was fancifully compared by the older writers to the lower part of the body and legs of a man, and some of them relate stories of its uttering a shriek when torn out of the ground. It is often mentioned in tales of witchcraft, and is named in Macbeth as an ingredient in the spells.

Petunia is a favourite tender annual in our gardens, from South America.

52. SCROPHULARIACEÆ.

Veronica. Speedwell. *fl.* a single flower; *fr.* | , a pistil cut open perpendicularly; *fr.*—, a pistil cut across. — *Digitalis purpurea.* Fox-glove. A spike of flowers and a leaf from the lower part of the stem.

This large order is composed of herbs or low shrubs, with alternate leaves and irregular flowers. The limb of the calyx occurs 4- and 5-parted, as does also that of the very variable corolla; sometimes this is spreading and only slightly irregular, as in *Veronica;* mostly, however, it is tubular, with an enlarged, often two-lipped mouth, the mouth being also often closed by an inverted pouch from the lower lip. The comparison of the corollas of *Veronica, Digitalis, Mimulus, Antirrhinum, Calceolaria,* &c. will illustrate its diversities. The stamens are also variable; sometimes there are but 2, sometimes 4, two long and two short (didynamous), or there are 4 and a rudimentary, or even a perfect, fifth.

The ovary is 2-celled, with the axile placentas in the middle of the transverse partition. Style single, seeds numerous. Fruit, a dry capsule.

These plants, found in all parts of the world, are mostly acrid or sedative, some very poisonous. The Fox-glove (*Digitalis purpurea*), is a violent poison, both in its leaves and seeds.

The Scrophulariaceæ are very great favourites in cultivation, from the beauty of the flowers of many genera, such as *Antirrhinum, Pentstemon, Linaria, Mimulus, Schizanthus, Collinsia, Veronica, Calceolaria, Salpiglossis*, &c., as also the climbing species of *Maurandya, Lophospermum*, and *Rhodochitum.* The *Buddleiæ* also belong here.

53. OROBANCHACEÆ.

This order is exclusively composed of brownish, often fleshy parasitic plants, growing attached to the roots of various herbs and shrubs or trees, from which they derive their nourishment. Their leaves are represented by small brownish or yellowish scales. Most of them have a tuberous or creeping rhizome, which in *Lathræa squamaria,* a parasite of beech-trees found in shady woods, is very beautiful when fresh; but the whole plant turns black as it decays or dries. The flowers closely resemble those of the Scrophulariaceæ in structure. Many *Orobanches* are found in England, as that on Clover (*O. minor*), that on Furze (*O. elatior*), &c. Other genera occur in North America, in the cooler parts of Asia, and at the Cape.

54. LABIATÆ.

Marrubium vulgare. Common Horehonnd. A flowering shoot; *fl.* a flower seen in profile; *fl.* +, a corolla slit and spread open.—*Salvia officinalis.* Garden Sage. A flowering shoot.

This natural order is composed of herbs or shrubs, mostly characterised by the presence of aromatic secretions upon the surface of the stems and leaves, contained in minute hairs. The leaves are placed in pairs, upon square stems, each pair standing across that above and below it. The flowers are borne in tufts in the axils of the leaves, and often so crowded as to form a kind of ring round the stem at the joint. The calyx has 5 or 10 more or less equal teeth; the mouth is decidedly 2-lipped, the lips being entire or toothed. The tubular corolla has a 2-lipped mouth, the upper lip being sometimes very small. The stamens are didynamous, or one pair is wanting, and only 2 stamens remain; sometimes one of the cells of the anther is barren and petaloid (*Salvia*). The ovary is deeply 4-lobed, with a central basilar style (as in Boraginaceæ), and the fruit consists of from 1 to 4 little nuts, formed from these lobes, surrounded by the persistent calyx.

These plants grow mostly in temperate or warm temperate climates. None of them are hurtful; many are valued for their aromatic oils, others for their brilliant flowers.

Of the aromatic kinds, among those used purely as perfumes are the Lavender (*Lavandula vera*), and other species; Patchouli (*Pogostemon Patchouli,* an East Indian plant); the oil of *Mentha citrata* is also very fragrant. Of the aromatic kinds used for flavouring in cookery, or as aromatic stimulants, are the Mints, such as *Mentha sativa,* Green or Spearmint; *Mentha piperita,* Peppermint; *Mentha Pulegium,* Pennyroyal, and other species; Rosemary (*Rosmarinus officinalis*); Sage (*Salvia officinalis* and *grandiflora*); Savoury, species of *Satureia;* Basils, species of *Ocymum;* Thyme (*Thymus Serpyllum*), and other species; Marjoram (*Origanum vulgare*); Hyssop (*Hyssopus vulgaris*).

Others are used as medicines, by the country people; as Horehound (*Marrubium vulgare*); Balm (*Melissa officinalis*); Calamint (*Calamintha officinalis*); as also the Ground Ivy (*Glechoma hederacea*); in fact, almost all our native Labiatæ are esteemed as medicinal by the herbalists. The subterraneous rhizomes of *Stachys palustris* are sometimes used as a vegetable, cut up in soups, &c. The common white and red Dead-nettles, *Lamium album* and *purpureum,* growing everywhere, derive their name from the resemblance of the leaves to those of the Stinging-nettles (*Urtica*). The coloured flowers at once distinguish them.

The large-flowered species of *Salvia,* crimson or blue, are showy garden plants, as also some kinds of *Stachys, Phlomis,* &c.

55. VERBENACEÆ.

This is a small order of plants allied to the Labiatæ, distinguished by the lobes of the ovary being closely conjoined and the style terminal. They are not usually aromatic.

Some kinds occur in the temperate, others in tropical climates, the latter are often large trees. One species of *Verbena* is native, Vervain (*V. officinalis*), but this is not very like the cultivated species, *V. Melindres,* &c., some of the numerous varieties of which are found in every summer garden. The Lemon plant, or Sweet Verbena of gardens, is now separated under the name of *Lippia citriodora.*

The Teak-tree, or "Indian Oak," as it was formerly called, belongs to this family. It is called *Tectona grandis;* it attains enormous dimensions, and forms forests on the mountains in Malabar, Pegu, and other parts of the East Indies. It is highly valued for ship-building.

56. ACANTHACEÆ.

Acanthus mollis. The Acanthus plant of the Greeks. A sprig of blossom and a leaf. —*Ruellia formosa.* The Scarlet Ruellia. A flowering shoot.

The Acanthaceæ are closely related to the Scrophulariaceæ and Bignoniaceæ, but differ in the character of the calyx and of the placentas in the ovary.

This family has no British representative, and most of the plants are tropical. The *Acanthus mollis,* or Sculptor's Acanthus, is supposed to have furnished the idea of the Corinthian capital, by spreading out under a tile or slab of marble. The Acanthaceæ are herbs or shrubs, some climbers, many with beautiful flowers. In our stoves are found species of *Ruellia, Thunbergia, Justicia, &c.*

57. PRIMULACEÆ.

Anagallis arvenis. Pimpernel, or Poor Man's Weather-glass. A flowering shoot; *fl.* a separate flower; *fr.* a ripe fruit bursting by a lid. —*Primula vulgaris.* The Primrose. Bud, flowers, and leaves.

The Primulaceæ are herbs, often of very humble growth, with tufted, opposite, or alternate leaves; the flowers often on long stalks running below the ground. The calyx is 4-, rarely 5-cleft, regular and persistent. The corolla 4- or 5-cleft, or in some cases (*Glaux*) absent. Stamens equal in number to the lobes of the corolla, and opposite them, or twice as many. Ovary 1-celled, with a free central placenta, and a single style with a thickened stigma. The capsular part opens entire by valves or by a lid falling off (*Anagallis*).

These plants have no active properties, and grow in temperate or cold, especially alpine, climates.

Many of the species of *Primula* are highly regarded in cultivation, such as the Primrose (*P. vulgaris*), the Auricula (*P. Auricula,* from the Alps); the garden Polyanthus is a variety of the Primrose; *P. veris* is the Cowslip, and *P. elatior* the Oxlip. *P. sinensis,* the China Primrose, is more delicate. The Cyclamens have tuberous roots; *C. europeum* is called for this reason Sow-bread, as its roots are grubbed up by swine.

Anagallis arvensis, the Shepherd's Weather-glass, is extremely common in fields, its delicate scarlet corollas only remaining open in the sunshine.

58. PLUMBAGINACEÆ.

An order of plants allied in many respects to the Primulaceæ, of which the common Thrift (*Armeria maritima*), and the "Sea Lavenders," species of *Statice,* are well-known examples. These plants are mostly sea-shore plants, but some are alpine, as *Plumbago,* and *Armeria maritima* seems to be both alpine and maritime.

59. PLANTAGINACEÆ.

Plantago major. Greater Road-weed. An entire plant with two spikes of blossom. On the right hand above, a spike of fruit; *fl.* a single flower in the axil of a bract; *fr.* a ripe fruit bursting by a lid.

This is an order consisting of unattractive weeds, mostly herbs with radical ribbed leaves, growing on roadsides, or in the mud of ponds or the sea. The calyx is 4-parted and persistent, the corolla of membranous texture, also 4-parted and persistent. Stamens 4, alternate with the lobes of the corolla. Ovary 2, or rarely 4-celled; style 1. Fruit, a membranous capsule opening by a lid, with a free central placenta.

The flowers and fruit of *Plantago* grow in long spikes, and those of *P. major* are gathered to feed cage-birds, under the name of Plantain or Road-weed.

INCOMPLETÆ.

60. Lauraceæ.
61. Myristicaceæ.
62. Polygonaceæ.
63. Chenopodiaceæ.
64. Amaranthaceæ.
65. Proteaceæ.
66. Ulmaceæ.
67. Piperaceæ.
68. Euphorbiaceæ.
69. Urticaceæ.
70. Amentaceæ.
71. Rhizantheæ.

60. LAURACEÆ.

Laurus nobilis. The Bay Laurel. A flowering shoot; *fl.* ♂, a barren or staminate flower; *fl.* ♀, a fertile or pistillate flower. — *Cinnamomum zeylanicum.* The Cinnamon-tree. A flowering shoot; *fl.* a separate flower; *fl.* |, a flower cut open perpendicularly; *fr.* a fruit.

The plants belonging to this order are trees, mostly tropical, the thick, usually alternate leaves of which exhibit numerous transparent dots (or glands). The floral envelopes consist of 4 parts standing in 1 circle, or 6 parts in 2 circles. The flowers are sometimes unisexual by suppression of organs; the stamens 8—12, some of the inner being abortive, the outer perfect. The 2- or 4-celled anthers burst by lid-like valves. The ovary is superior, 1-celled, and contains 1 or 2 ovules. Fruit, a berry or a fleshy drupe, with only one seed.

The Lauraceæ are renowned for their aromatic properties, for they contain essential oils and camphor. They also yield fixed oils; their bark is sometimes tonic and febrifugal, and some kinds yield edible fruits.

Among the best known products of this family are Cinnamon and false Cinnamon or Cassia bark, derived from the *Cinnamomum zeylanicum* and *C. Cassia,* both East Indian plants. Camphor is extracted from the wood of *Camphora officinarum* (*Laurus Camphora* of old authors) in China and Japan.

Laurus nobilis, the Bay or classic Laurel, cultivated with us, but a native of South Europe, &c., yields a thick oil. The leaves are aromatic, as also the berries. The fruit of *Persea gratissima,* a tropical tree, is highly esteemed under the name of the Avocada Pear.

Several of the South American Lauraceæ are valuable timber trees.

61. MYRISTICACEÆ.

Myristica moschata. The Nutmeg-tree. A shoot bearing a ripe fruit; *fl.* a flower; *fl.*+, a flower cut open; *st.* the stamens after the perigone has been removed; *p.* the pistil; *fr.* | , a ripe fruit cut open, showing the seed (nutmeg) surrounded by the mace.

This small order of plants consists also of tropical trees, with the staminate and pistillate flowers distinct. The perianth is 3- or 4-cleft. The stamens from 3 to 12, either free or all united together. Pistillate flowers with a deciduous perianth with one or many pistils, each containing a single ovule. Fruit succulent, bursting into 2 parts, containing a large seed surrounded by an arillus.

Acrid and aromatic in their properties. The Nutmeg-trees are several, but *Myristica moschata* yields the true nutmeg of the Spice Islands. This is the seed, enclosed in a large fleshy pulp, bursting into two valves when ripe, and exposing the seed coated with a laminated arillus (Mace), of a beautiful red colour when fresh. More than a dozen other species of *Myristica* have been discovered in South America, with fruits resembling the true nutmeg, but inferior; some other kinds are met with in commerce under the names of Brazilian, false, or wild nutmegs. One kind of Brazilian nutmeg, however, and the Clove-nutmeg, are the fruits of Lauraceous trees.

62. POLYGONACEÆ.

Rumex crispus. Curled Dock. The right-hand figure a raceme of flowers; in the middle a sprig of flowers from the preceding, with a detached leaf; on the left a sprig of fruits; *fl.* a separate flower; *p.* a pistil; *fr.* |, a fruit cut open perpendicularly. — *Polygonum aviculare.* Common Knot-grass. A flowering shoot; *fl.* a separate flower. — *Rheum,* Rhubarb. *fl.* a separate flower; *stp.* the stamens and pistil after the perigone has been removed.

The plants included in this order are almost all herbs, some producing leaves of very large size, which are alternate and are especially distinguished by a peculiar kind of membranous, tubular sheath (*ochrea*), surrounding the base of their stalks and the part of the stem where they arise. The flowers are either perfect (containing stamens and pistils) or imperfect. The perianth is coloured or greenish, 6-leaved, the stamens 3—6—9, mostly inserted on the base of the perianth. The 3 carpels are united into one ovary containing a single seed, usually ripening into a little triangular nut, ordinarily containing much starch.

The Polygonaceæ are widely spread, in extremely cold and in tropical climates. Their properties are acid, astringent, and purgative as to their juices; the seeds of some contain enough starch to allow of their being used instead of corn.

Rumex is the generic name of the Sorrels and Docks of our meadows and ditches. *R. acetosa* and *acetosella,* native, and *R. scutata,* cultivated, are sorrels used for salads, &c., containing oxalic acid. *R. alpinus,* Monk's Rhubarb, and other species, have purgative roots.

Polygonum is the generic name of a number of common weeds with more or less acrid juices. *P. hydropiper,* Water-pepper, grows commonly in ditches. The creeping stems of some are edible. *Fagopyrum esculentum,* is the Buck-wheat, cultivated in Britain only for game; but for human food on the Continent, and especially (with *F. sibiricum*) in northern Asia.

Rheum palmatum, undulatum, and other species furnish the Rhubarb root used in medicine. The leaf-stalks of highly-cultivated examples of the same plants furnish the Rhubarb used for tarts, &c. The acid flavour depends on oxalic acid.

63. CHENOPODIACEÆ.

Salsola Kali. Prickly Salt-wort, or Soda-plant. A flowering shoot; *pt.* a petal; *stp.* stamens and pistil after the floral envelopes have been removed; *e.* the embryo extracted from a seed.—*Salicornia herbacea.* Jointed Glass-wort. *fl.* two joints of the stem with the flowers embedded in them; *st.* a stamen; *p.* a pistil.

An order of unattractive herbs or low shrubs found in all parts of the globe, abundantly as rank weeds in waste places with us. The leaves are without stipules, rarely inconspicuous (*Salicornia*), often covered with a mealy substance. Flowers small, green, often imperfect; perianth deeply divided, sometimes tubular at the base, persistent; stamens attached to the base of the perianth opposite its divisions; ovary 1-celled, free, with one ovule. Fruit, a kind of small nut, or sometimes succulent.

Some of the Chenopodiaceæ are eaten as table vegetables, such as Spinach (*Spinacea oleracea*), Beet (*Beta vulgaris*); varieties of latter, form also the Beets and Mangold-wurzels of agriculture. Beet-root is grown largely for the manufacture of sugar in France. *Salsola Kali* and the *Salicorniæ*, Glassworts, are sea-side plants containing much soda; they formerly constituted the chief source of this substance in Barilla, which consists of their ashes.

Some of the exotic kinds are important. The seeds of *Chenopodium Quinoa* are used for food in Peru.

64. AMARANTHACEÆ.

These plants are herbs or shrubs, with leaves either opposite or alternate, devoid of stipules. The flowers, sometimes imperfect, are coloured, provided with bracts and arranged in close heads or dense spikes. The perianth consists of 3—5 membranous sepals. Stamens 5, free or monadelphous; anthers sometimes 1-celled. Ovary with a single ovule.

The Amaranthaceæ are most common in warm countries, but several are cultivated in our gardens, as *Amaranthus caudatus,* Love-lies-bleeding, and *A. hypochondriacus,* Prince's feathers. The more tender Cockscomb, *Celosia cristata,* also belongs here. They have no important properties.

65. PROTEACEÆ.

Banksia spinulosa. Prickly-leaved Banksia. A head of flowers, and *fr.* a head of fruit; *fl.* a separate flower; *p.s.* a pistil and a sepal; *st.* a stamen.—*Dryandra carduacea.* Thistle-leaved Dryandra. A flowering shoot; *fl.* a separate flower.

This is a remarkable order of shrubs or small trees, chiefly natives of Australia and the Cape, having dry, rigid, evergreen leaves without stipules, and flowers collected into heads or scattered in the axils of leaves. The perianth, often brightly coloured, has 4 parts, valvate in the bud. Stamens 4, on the lobes of the perianth; ovary single and simple, with 1 or more ovules.

These plants have no important uses, and grow chiefly in waste places. They are, however, greatly valued in (greenhouse) cultivation, on account of the curious and often beautiful foliage, and their frequently brilliant-coloured blossoms. Species of *Banksia, Grevillea, Protea, Leucadendron,* &c. are well known in cultivation.

66. ULMACEÆ.

The Elm order consists of trees or shrubs with alternate, stipulate leaves, with a rough surface; they bear loose clusters of perfect or imperfect flowers. The perianth is membranous, bell-shaped, and irregular, inferior. Stamens of definite number, attached to the perianth; ovary free, 1—2-celled, ovules solitary; stigmas, 2. Fruit 1- or 2-celled, dry or drupaceous, indehiscent.

These plants are chiefly found in northern climates; some of them possess bitter and astringent bark.

Of the Elms, species of *Ulmus,* two occur in Britain, *U. campestris,* the common English Elm, and *U. montana,* the Scotch or Wych Elm; the latter has much larger leaves than the former. *Celtis occidentalis, orientalis,* and *australis,* the Nettle-trees, are cultivated.

67. Piperaceæ.

Piper nigrum. Black Pepper. A shoot with a spike of fruit above and of flowers below. *fl.*+, a flower laid open; *p.* a pistil; *fr.* a fruit (berry) cut open to show the seed. — *Chavica officinarum.* Long Pepper. A shoot with a spike of fruit.

A remarkable order of tropical herbs or shrubs with jointed stems and broad leaves, either opposite or whorled, sometimes furnished with stipules; the perfect flowers are in the axils of bracts and devoid of a perianth, consisting merely of 2 or more stamens and a free 1-celled ovary, with 1 erect ovule. Fruit somewhat fleshy, solitary, or in close spikes.

The species of *Piper* and *Chavica* are highly important. *P. nigrum,* an East Indian climber, furnishes black and white Pepper, the former being the unripe fruit, the latter the ripe fruit decorticated. Long Pepper consists of the dried spikes of *Chavica officinalis, Roxburghii,* and other species. The plants of this family are aromatic and pungent, some also narcotic; several of them are used in medicine.

68. Euphorbiaceæ.

Euphorbia Lathyris. Caper Spurge. A sprig with fruits; *fl.* ♂, a detached staminate flower. — *Ricinus communis.* On the left hand, a shoot bearing staminate and pistillate flowers; *b.* leaf behind; *fl.* ♀, a fertile (pistillate) flower; *fl.* ♂, a barren (staminate) flower.

This important order includes trees, shrubs, and herbs, with opposite or alternate, soft or evergreen leaves, often with stipules; the flowers are surrounded by involucres, are imperfect, and sometimes without a perianth, which when existing is inferior. Stamens definite or indefinite, free or united into 1 or more bundles. Ovary 1, 2, 3, or many-celled, with 1 or 2 suspended ovules in each cell. Fruits dry, the constituent carpels separating with elasticity.

The plants of this family are mostly acrid and poisonous, and occur all over the world; they mostly contain a milky juice, and species of this character, yielding caoutchouc, are very numerous in South America. Some are timber trees.

Among the most remarkable kinds are the *Euphorbiæ,* many wild herbaceous kinds of which occur as weeds, called Spurges, in Britain and the rest of Europe. The *Euphorbiæ* of warmer regions are of different character, being spiny shrubs, with scattered leaves, and often coloured involucres. *E. antiquorum, E. officinarum,* and *E. canariensis,* furnish a purgative resin called Euphorbium. Some of these spiny kinds, like the Cactaceæ, form impassable hedges. The Manchineel, *Hippomane Mancinella,* has a deadly juice. Species of *Jatropha* (*J. Curcas,* the physic-nut), has cathartic seeds; *Croton Tiglium* furnishes Croton oil, pressed from its seeds; and *Ricinus communis,* Castor oil. The leaves of the Box, *Buxus sempervirens,* are purgative.

The active qualities of many Euphorbiaceæ are removed by heat, as in the case of the leaves of *Jatropha Curcas;* while the nutritious starch of *J. Manihot* (Cassava and Tapioca) is obtained by washing away the narcotic juice with water.

Many of these plants furnish caoutchouc, some form an important source, as *Siphonia elastica,* a native of Brazil and Guiana. The timber of other kinds is highly valued, as that of the Box, for its density and fine grain, and that of the African Teak or African "Oak," *Oldfieldia africana,* which is still heavier and harder than that of East Indian Teak.

Stillingia sebifera yields a fatty substance used for making candles; it is called the Chinese Tallow-tree. The dye Turnsole is obtained from *Crozophora tinctoria.* The fruit of *Rottlera tinctoria* yields a red dye. The juice of *Omphalea triandra* (Guiana) turns black, and is used as ink.

69. URTICACEÆ.

Urtica urens. The small Stinging-nettle. Top of a flowering stem; *fl.* ♂, a staminate flower; *fl.* ♀, a pistillate flower. —*Ficus Carica.* The Edible Fig. A shoot bearing a fruit; *inf.* |, a young fruit (inflorescence) cut open perpendicularly to show the flowers growing in its interior; *fl.* ♀, a pistillate flower; *fl.* a perfect flower. —*Morus niger.* The Mulberry-tree. A shoot with heads of flowers above, and the same ripening into fruit below; *fl.* ♀, a pistillate flower;

fl. ♂, a staminate flower. — *Humulus Lupulus.* The Hop plant. ♂, a sprig of a barren plant, bearing only staminate flowers; *fl.* ♂, one of its flowers detached; ♀ sprig of a fertile plant, bearing only pistillate flowers, with ripe fruit; *fr.* a fruit detached to show the position of the seed.

A large order of highly important plants, consisting of herbs, shrubs, and trees, with a watery or a milky juice, and stipulate leaves, sometimes clothed with stinging hairs. The flowers are collected in heads or catkins, or are scattered; they are generally imperfect, rarely perfect. The perianth is divided; the stamens equal the number of the lobes of the perianth, and stand opposite to them. The ovary is superior, 1-celled, with 1 ovule. Fruit indehiscent.

These plants occur in all parts of the world, as herbs in temperate climates, and often as trees in the tropics.

They are divided into 4 sub-families:

1. URTICEÆ, have a watery juice, erect albuminous seeds, and a straight embryo.

2. CANNABINEÆ, have a watery juice, and suspended exalbuminous seeds, with a twisted or spiral embryo.

3. ARTOCARPEÆ, have a milky juice, seeds with a variable amount of albumen, embryo straight (tropical).

4. MOREÆ, have a milky juice, seeds with a fleshy albumen, and a hooked embryo.

1. The *Urticeæ* include the common stinging Nettles, *Urtica dioica* and *urens*, which, like other kinds of this family, contain a tough fibrous liber, capable of being used for textile fabrics, &c. That of *U. tenacissima* is employed in Sumatra for cordage. *Bœhmeria nivea* yields the material of Chinese grass-cloth. *B. Puya,* the film called Puya.

The stings of some of the tropical Urticeæ are exceedingly severe.

2. *Cannabineæ,* deriving their name from *Cannabis sativa,* the Hemp-plant, have similar uses, and the variety of this plant growing in India possesses also powerful narcotic properties. *Humulus Lupulus,* the Hop, valued for the tonic and narcotic properties of its fruits, has also a tough fibre.

3. *Artocarpeæ,* are so called from the *Artocarpus incisa,* the Bread-fruit tree, and *A. integrifolia,* the Jack-fruit, another

species. Some of the plants of this sub-family are, however, highly poisonous. This is especially the case with the Javanese *Antiaris toxicaria.* Some have fibrous barks. The milky juice of some abounds in Caoutchouc, and in the *Galactodendron utile,* or South American Cow-tree, the abundant emulsion-like juice of which is very nutritious.

4. *Moreæ,* include *Morus nigra,* the cultivated black Mulberry, and *M. alba,* on the leaves of which also silkworms are extensively fed. The Paper-mulberry, *Broussonetia papyrifera,* is used in China and Japan for making a kind of paper. *Ficus Carica,* the common Fig, belongs here, as also *Sycamorus antiquorum,* the Sycamore fig. *Maclura tinctoria* furnishes the yellow dye-wood called Fustic. *Ficus elastica,* and other species, furnish abundance of Caoutchouc. *Ficus indica* is the celebrated Banyan-tree of Hindostan.

70. AMENTACEÆ.

Quercus Robur. The common Oak. A shoot with barren and fertile blossom; *fl.* ♂, a staminate flower from the barren blossom; *fl.* ♀, a fertile inflorescence; *fr.* the fruit (acorn) produced from the preceding. — *Salix fragilis.* Crack Willow. A sprig with catkins, and another with leaves; *inf.* a fertile catkin; *fl.* ♂, a barren (staminate) flower detached; *fl.* ♀, a fertile (pistillate) flower detached. —*Juglans regia.* The Walnut-tree. A shoot with barren and fertile blossoms; ♂, barren inflorescence; *inf.* ♀, fertile inflorescence; *fl.* ♀, fertile (pistillate) flower; *fl.* ♂, barren (staminate) flower; *fr.* fruit. — *Carpinus Betulus.* The Horn-beam. A shoot with fertile (♀) and barren (♂) catkins; *fr.* a single fruit, detached from a catkin.

Trees or shrubs, with alternate leaves devoid of stipules, bearing the flowers in catkins, or the staminate in catkins and the pistillate in small tufts. Flowers imperfect. Perianth cup-like, or consisting of minute scales. Stamens 2—30, or 5—20. Ovaries, superior or inferior, 1—2 or many-celled. This family, including most of our native timber trees, is divided into a number of sub-families.

1. SALICINEÆ. Leaves simple, sometimes with petiolary glands. Flowers all in catkins. Perianth wanting or cup-like. Stamens 2—30. Ovary superior, 1-celled; stigmas 2, ovules numerous. Fruit leathery, with many seeds, covered with silky hairs.

2. Betulineæ. Leaves stipulate; flowers all in catkins; perianth represented by small scales; stamens opposite the scales; ovary 2-celled; ovules 1 in each cell; stigmas 2; fruit 1-celled, 1-seeded.

3. Quercineæ. Leaves stipulate; barren flowers in catkins; fertile, aggregated in tufts, or in a spike; perianth scaly or membranous and valvate; stamens 5—20, fixed at the base of the scales. Ovary with several cells, with an adherent perianth, and inclosed in an involucre (cupule); stigmas several; ovules in pairs, or solitary. Fruit a nut, 1-celled, 1-seeded.

4. Plataneæ. Leaves palmate or deeply toothed, stipulate; flowers in globular catkins; nut club-shaped, with a persistent style.

5. Juglandeæ. Leaves pinnate, stipulate; barren flowers in catkins, with a 2—3—6 parted perianth, and a scaly bract. Fertile, in terminal clusters or lax racemes, with distinct or confluent bracts; perianth adherent. Ovary 2—4-celled below, 1-celled above; ovule solitary. Fruit a nut with an exalbuminous 4-lobed seed.

1. The *Salicineæ* include the Willow (*Salix*), and Poplars (*Populus*), useful for timber and other purposes. The bark is tonic. The species of Salix called Willows, Sallows, Osiers, &c., are used for baskets, and for making charcoal. *Salix babylonica* is the Weeping Willow. *Populus alba* is the Abele or White Poplar; *P. nigra* the Black Poplar, of which the tall variety *fastigiata* is the Lombardy Poplar; *P. tremula* is the Aspen.

2. Among the *Betulineæ* many Birches (*Betula*) and Alders (*Alnus*) are of interest and importance. These two genera occur at the limits of arborescent vegetation, both at the poles and on mountains. The Birches *B. alba* and *glutinosa* yield an empyreumatic oil from the bark, used in the preparation of Russia leather, giving the peculiar odour.

3. The *Quercineæ* are very important both as timber trees and for their fruits. The Oaks (*Quercus*) abound in forests of temperate regions. The English species (*Q. Robur*), is distinguished into two kinds, *pedunculata* and *sessiliflora*, accord-

ing to the way in which the fruit is attached. *Q. Ilex,* the Evergreen oak, is an introduced species belonging to South Europe, where many other kinds grow, such as: *Q. Ægilops,* the acorn-cups of which are used in dyeing under the name of Valonia; *Q. coccifera,* the Kermes oak, deriving its name from an insect which infects it, yielding a red dye; *Q. infectoria,* on which Nut-galls are produced through another insect; *Q. Suber,* the Cork-tree or Cork-oak. About 100 species occur in the old world, and as many in the new. The acorns of some of the South European and other species are eaten.

Fagus sylvatica, the beech, is another valuable native timber-tree. An evergreen beech, *F. Forsteri,* occurs in Tierra del Fuego. Pigs are fed on the nuts, beech-mast. *Castanea vesca,* the Spanish Chestnut, yields a more valuable fruit, while its timber is greatly esteemed. There is a North American species, *C. americana,* which has rather smaller nuts. *Corylus Avellana* is the Hazel or Filbert-tree, of which several varieties exist in cultivation, called white and red filberts, cob-nuts, &c. The oil they yield is greatly used in painting. *Carpinus Betulus,* the Horn-beam, is remarkable for the hard, heavy character of the wood. *Ostrya virginiana* is another hard, heavy timber-tree, called in America Iron-wood.

4. Of the *Plataneæ,* the Planes, *Platanus occidentalis,* and *P. orientalis,* from America and Asia, are chiefly cultivated for their beauty with us, but the timber is fine grained, hard, and handsome, when old.

5. The *Juglandeæ* yield valuable fruit and timber. *Juglans regia,* the Walnut-tree, is well known on both accounts. It is not a native of Britain. The seeds are enclosed in a succulent husk, the juice of which, like that of the leaves, stains the skin. *J. nigra* has a darker coloured timber. *J. cinerea* yields the "Butter-nut" of Canada. *Carya* is the generic name of the Hickories of North America; *Carya alba,* the common Hickory, has an edible nut, as also has *C. olivæformis* (called the Peccan-nut). The timber of the Hickory is tough and elastic.

71. RHIZANTHEÆ.

Cytinus Hypocystis. An entire plant growing upon the root of a Cistus; *fl.* a detached flower. — *Helosis guianensis.* Several entire plants parasitic upon a root. — *Rafflesia Arnoldi.* An expanded flower growing from the root of a Cissus. — *Brugmansia Zippelii.* Side view of a flower springing from the root upon which it is parasitic; on the right hand, two unopened buds also springing from a foreign root.

These remarkable plants are leafless parisites, of fleshy texture, growing upon the roots of other plants, upon which they are as it were naturally grafted, like Mistletoe on the Apple or Oak. They bear flowers, sometimes very large, either sessile or supported on stems. These have true stamens and carpels, but the seed is an obscure structure, not always exhibiting a perfect embryo.

The consistence of these vegetables resembles that of the Fungi; their appearance is diversified, and they are divided into several groups. All appear to be astringent.

1. BALANOPHOREÆ produce a tuberous stem, from which rise naked or scaly stalks bearing heads of imperfect flowers. Fruit 1-seeded. They are mostly natives of tropical mountains, but one kind grows in Malta, *Cynomorium coccineum*, which has a very old reputation for its styptic properties. They are parasitical on the roots of various Dicotyledons.

2. CYTINEÆ, have either solitary stemless flowers, or these arise in the axils of bracts on a scaly stalk. Fruit many-seeded, anthers bursting by slits. Some are parasitic on the roots of species of *Cistus,* others on certain succulent plants. *Cytinus hypocystis* grows in the South of Europe, the other species are found at the Cape of Good Hope.

3. RAFFLESIEÆ. These are parasitic on the branches of trees; the flowers are stemless and sometimes very large (*Rafflesia,* 3 feet across). Fruits many-seeded, anthers bursting by pores. *Rafflesia* and *Brugmansia* are natives of the East Indies, parasitic on species of *Cissus* (a kind of Vine); others are found in South America, parasitic on Leguminosæ.

MONOCOTYLEDONS.

PETALOIDEÆ.

72. Orchidaceæ.
73. Scitaminaceæ.
74. Musaceæ.
75. Hæmodoraceæ.
76. Iridaceæ.
77. Bromeliaceæ.
78. Amaryllidaceæ.
79. Liliaceæ.
80. Asparageæ.
81. Melanthaceæ.
82. Dioscoreaceæ.
83. Smilaceæ.
84. Hydrocharidaceæ.
85. Commelynaceæ.
86. Juncaceæ.
87. Alismaceæ.
88. Butomaceæ.

72. ORCHIDACEÆ.

Orchis mascula. The early purple Orchis. An entire plant; _fl._ a detached flower, side view; _stp._ the stigma and stamens seen in front.

This strange order of plants consists of terrestrial or epiphytic herbs, with tuberous roots or stems, forming false bulbs. The leaves are entire, usually flat, and often sheathing at the base. The flowers are perfect, with a coloured perianth of most diversified character, and are commonly arranged in spikes or racemes. The perianth is formed of 3 outer segments and 3 inner, one of the latter being much more developed than the rest, and called the lip or label; it is often spurred or furnished with various appendages. The flowers sometimes closely imitate the forms and colours of insects, bees, butterflies, &c. The most distinctive character lies in the stamens. Usually 1 only exists, confluent with the prolongation of the germen, called the column; sometimes 2 stamens exist, similarly confluent, as in *Cypripedium.* The pollen is often in wax-like masses, furnished with a kind of stalk. The germen is inferior, 1-celled, with 3 parietal placentas bearing many ovules. The germen is often twisted at the time of flowering so as to bring the upper petal (lip) to the front or lower part. Fruit, a dry capsule; seeds minute.

The Orchids are found in most parts of the world; the terrestrial kinds in temperate climates, the aerial or epiphytic, very numerous, chiefly in the tropics of the old and new worlds. Many are fragrant; the tubers of some contain much mucilaginous matter.

More than a dozen terrestrial species grow wild in Britain. Some, such as *Orchis mascula,* the early purple Orchis, are tolerably common. The Fly Orchis (*Ophrys muscifera*), Bee Orchis (*O. apifera*), Man Orchis (*Aceras anthropophora*), and others occur mostly on chalk downs.

The epiphytic kinds of warm climates are very curious, and exceedingly varied in form, colour, and habit of growth. They are not parasites, but merely find support on branches of trees, &c., absorbing moisture by their aerial roots and leaves. A great number are cultivated in this country, in houses especially adapted for them. Among familiar genera are: *Oncidium, Maxillaria, Epidendrum, Dendrobium, Stanhopea, Lælia, Cattleya, Vanda, Phalænopsis,* &c. *Vanilla planifolia* and *V. aromatica,* and other species, have a fragrant substance in the ripe seed-vessel, used, under the name of Vanilla, or *Vanille,* for flavouring chocolate. These are natives of the West Indies and adjoining countries.

Cypripedium, of which one species, *C. Calceolus* (the Lady's Slipper Orchis), is a very rare British plant, is remarkable for the development of 2 stamens, right and left, instead of the odd (anterior) one commonly found. The perianth has two of its outer segments confluent, so as to appear 5-lobed.

73. SCITAMINACEÆ.

Maranta arundinacea. The Arrow-root plant. A rootstock or rhizome bearing leaves, and a flowering sprig; *st.* a stamen. —*Zingiber officinalis.* The Ginger plant. An entire plant; *l.* leaf and leaf-sheaths; *fl.* a detached flower.

The Scitaminaceæ are tropical plants, with starchy rhizomes or subterraneous rootstocks; their leaves are broad, and have a midrib and parallel secondary veins. The flowers are in spikes, with large bracts. According to certain differences in the flowers, they are divided into two families by most authors.

1. ZINGIBERACEÆ. Perianth tubular, irregular, in 3 rows, each 3-parted, one lobe of the second and third circles differing from the rest. Stamens properly 3, but only the posterior perfect, the two lateral abortive, anther 2-celled. Fruit a 3-celled dry capsule or a berry.

2. MARANTACEÆ. Flowers as before, except that the one perfect stamen is lateral, with a petaloid filament and only one cell, while the stigma is petaloid.

1. The *Zingiberaceæ* take their name from the Ginger-plant, *Zingiber officinale*, the officinal part of which is the dried aromatic rhizome. Preserved Ginger is made of the young rhizomes, before they have become woody. The aromatic property is shared by most of the plants of this family. Cardamom seeds are obtained from various species of *Amomum;* Turmeric, used for flavouring and colouring curry powder and Indian pickles, consists of the rhizomes of *Curcuma longa.* Galangale root is the rhizome of *Alpinia Galanga.*

Many of the species of *Curcuma* have abundance of starch in their ripe rhizomes, and these furnish some of the East Indian Arrow-root.

2. The *Marantaceæ* take their title from the genus *Maranta*, the best known species of which, *M. arundinacea*, furnishes West Indian Arrow-root, the abundant starch from its rhizomes. Most of the Marantaceæ afford large quantities of fecula; thus *M. indica* and *M. nobilis* are also Arrowroot plants, while various species of *Canna*, such as *C. coccinea*, *C. edulis*, and others, yield the substance called Tous-les-mois.

74. MUSACEÆ.

Strelitzia regina. A blossom.—*Musa sapientum.* The Banana-tree. A tree bearing blossom and fruit; *fr.* a bunch of fruit.

This important order of tropical plants contains species which acquire arborescent dimensions, as in the *Musæ*, Bananas and Plantains. The trunks of these, however, are merely gigantic columnar *bulbs*, being formed of the sheaths at the bases of the large leaf-stalks. The leaves have a midrib with parallel secondary veins. The flowers are produced in the axils of large bracts and are irregular, the perianth presenting 2 circles of lobes, 3 in each. Stamens 6, inserted on the perianth. Fruit either a 3-celled capsule or a succulent berry.

These plants are not less remarkable for their beauty than their utility. The Banana (*Musa sapientum*) and the Plantain (*M. paradisiaca*) have magnificent foliage, while their fruit, produced in great abundance, forms a principal article of food in the regions where they flourish. The leaves and the fibres of these, and their stalks, serve many purposes of domestic economy; the Manilla hemp, used for manufacturing a very fine linen fabric, is the fibre of *M. textilis.* The young shoots of the *Musæ* are also eaten as green vegetables.

Strelitzia regina is an exceedingly handsome plant with large purple and orange flowers.

75. HÆMODORACEÆ.

Vellozia aloefolia. The upper part of a stem, with leaves and flowers; *fl.* a detached flower; *stp.* stamens and pistil with the perianth removed; *p.* |, the pistil cut open perpendicularly.—*Barbacenia bicolor.* An entire shrub.

This is a tropical order containing plants which often produce woody stems, sometimes branched, with numerous fibrous roots, and persistent sword-shaped leaves equitant at the base. The flowers have a 6-parted tubular perianth, the outside of which, like the stems, is often covered with scurfy or woolly hairs. Stamens either 3 opposite the inner 3 segments of the perianth, or 6; anthers introrse. Ovary 3 or sometimes 1-celled. Style and stigma simple. Fruit usually capsular, and crowned by the withered perianth.

These plants are chiefly interesting in a botanical point of view; though the rootstocks of some are edible. The most remarkable genera are: *Vellozia,* consisting of branching plants, sometimes called "Tree-lilies," natives of Brazil; *Hæmodorum,* some of which are roasted and eaten at Swan River; and *Barbacenia,* some of which have flowers sufficiently attractive to give them a place in stoves where tropical plants are cultivated.

76. IRIDACEÆ.

Iris germanica. Garden Flag. A detached flower; *stp.* stamens and pistil after the removal of the perianth; *fr.* the ripe fruit burst. — *Crocus sativus.* The Saffron Crocus. A flowering stem; *st.* the top of a stamen; *stg.* the style with its petaloid stigmas.

This order consists of herbs having either corms (or solid bulbs) or creeping subterraneous rhizomes, with fibrous roots. The leaves are linear or sword-shaped, mostly equitant, and the flowers with a large membranous bract, called a spathe. The perianth is composed of 6 parts in 2 circles, regular (*Crocus*) or irregular (*Gladiolus*, &c.). Stamens 3, inserted at the base of the 3 outer segments. Anthers extrorse. Ovary inferior, 3-celled, crowned by a single style, bearing 3 more or less developed petaloid stigmas. Fruit a 3-celled dry capsule.

Natives of various regions, temperate and warm; very abundant at the Cape of Good Hope. Some have active properties, being purgative or emetic; many contain abundance of starch in their corms or rhizomes.

The species of *Iris*, or Flag, or Flower-de-Luce, are very numerous; the rhizome of *I. florentina* is the fragrant substance called Orris-root. The fresh rhizomes of all the kinds are acrid, some purgative or emetic.

Crocus sativus is the Saffron Crocus, this substance consisting of the yellow petaloid stigmas. Many favourite garden plants belong to this family, in addition to various kinds of *Iris* and *Crocus*, such as *Gladiolus, Ixia, Tigridia, Watsonia*, &c.

77. BROMELIACEÆ.

Bromelia Ananas. The Pine-apple. A head of blossom; *fl.* a flower detached from this; *fr.* the fruit produced from it. — *Billbergia Morelliana.* A raceme of flowers with the outline of a leaf behind; *st.* a stamen; *p.* —, a pistil cut across; *p.* |, a pistil cut open perpendicularly.

This order consists of plants mostly native of tropical America, very often epiphytic, like the Orchids, characterised by rigid, channelled leaves, often spiny, and with a scurfy surface. The stems are sometimes considerably developed. The flowers are showy, arranged either in dense spikes or loose racemes, each in the axil of a large, often petaloid bract. The perianth is composed of 2 circles of 3 segments, the outer 3 persistent, often of different colour from the inner 3, which wither. Stamens 6, inserted on the tube of the perianth; anthers introrse. Style single; stigmas 3, spirally twisted. Fruits variable.

This family contains plants of great interest; such as the Pineapple (*Bromelia Ananas*, or *Ananassa sativa*), the fruit of which is formed out of the entire spike of flowers with their central stem and bracts fused into a succulent mass. The fibres of this plant are used extensively for cordage in the West Indies, and cloth has been made from them.

The species of *Æchmea, Billbergia, Pitcairnia,* &c. have very beautiful flowers. The *Tillandsiæ* are also often handsome. One kind, *T. usneoides*, epiphytic, producing a mass of dark fibres hanging down from the branches of trees, is called Spanish Moss, from the resemblance to a Lichen or Scale-moss. It is sometimes used for stuffing cushions, &c.

78. AMARYLLIDACEÆ.

Galanthus nivalis. The Snow-drop. A flower naturally opened; *fl.* a flower pulled open and viewed from above. — *Narcissus Pseudo-narcissus.* The Common Daffodil. A detached flower. — *Agave Americana.* The American Aloe, or Hundred-years Plant. An entire plant; *fl.* a detached flower.

Herbs with either bulbs or small rootstocks with abundant fibrous roots; leaves sword-shaped, flowers showy, mostly with a membranous spathe. Perianth coloured, 6-parted, sometimes with a nectary or crown in the throat (*Narcissus*). Stamens 6, inserted at the base of the segments, sometimes united by a membrane; anthers introrse. Ovary inferior, 3-celled; stigmas 3-lobed. Fruit a 3-valved capsule, or a succulent berry.

These plants occur in all parts of the globe, but most abundantly at the Cape of Good Hope. Many of them possess poisonous properties, others are innocuous, while many are cultivated on account of the beauty of their flowers.

The species of *Narcissus,* of which *N. Pseudo-narcissus* is the common Daffodil, *N. poeticus,* the Narcissus of gardens, &c., are more or less active, the flowers narcotic, the bulbs emetic. *Hæmanthus toxicarius,* and other Cape species, have poisonous juice in their bulbs, used by the Hottentots for poisoning arrows. The *Agave Americana,* or so-called "American Aloe," is vulgarly supposed to flower once in a hundred years. The fact is, the enormous bulb-like mass does not accumulate sufficient store of food for its flowering until many years have elapsed; not, however, 100. When the flowers are produced and the seeds ripened, the whole parent plant dies away, its growth being continued by axillary buds, which become free on the decay of the parent. The stems and leaves of *Agaves* contain abundance of liquid, just before flowering, capable of being fermented into a spirituous liquor, called Pulque. The fibres are also available for the manufacture of textile fabrics, string, paper, &c.

Among the favourite garden-plants of this family are the Snow-drop (*Galanthus nivalis,* British), the Snow-flake (*Leucojum æstivum*), various species of *Amaryllis, Crinum, Pancratium, Narcissus, Alstrœmeria,* &c.

79. LILIACEÆ.

Allium sativum. Garlick. A bulb and a head of blossom. — *Lilium candidum.* The White Lily. The top of a flowering stem. — *Aloe socotrina.* The Socotrine Aloes plant. A shrub in blossom. — *Xanthorrhœa hastilis.* The Australian Grass-tree. A tree with its spike of blossom.

This is a large and interesting order of plants, consisting of herbs, shrubs, and even trees, with bulbs, rhizomes, corms, or fibrous roots. The leaves are simple, sheathing at the base. The flowers are regular, with a perianth of 6 parts, either distinct or united. Stamens 6, inserted on the perianth; anthers introrse. Ovary superior, 3-celled; style 1; stigma simple or 3-lobed. Fruit a 3-celled capsule.

These plants occur both in temperate and warm climates. They are often subdivided into a number of sub-families:—

1. TULIPEÆ. Bulbous plants with annual stems; flower without a spathe, composed of six almost free segments; the anthers lightly attached to the filaments.

2. HEMEROCALLIDEÆ. Perianth with a distinct tube, often without a bulb.

3. ALOINEÆ. Foliage of thick succulent persistent leaves.

4. SCILLEÆ. Filaments thick; frequently with a membranous spathe.

5. ANTHERICEÆ. Roots fasciculate.

6. APHYLLANTHEÆ. Plants with the habit of Rushes, with imbricated membranous bracts.

1. The *Tulipeæ* are chiefly remarkable for their showy flowers, rendering them favourite garden plants, as the Tulip (*Tulipa Gesneriana*), the Crown Imperial (*Fritillaria imperialis*), and other species of *Fritillaria*, the Dog's-tooth violet (*Erythronium Dens Canis*), &c. with the numerous species of *Lilium*, such as *L. candidum*, the White Lily, *L. chalcedonicum*, the Scarlet Lily, &c. The Crown Imperial and *Gloriosa superba* are very poisonous. Some of these plants are nutritive, as the Kamtschatka Lily (*L. pomponium*), the bulbs of which are eaten.

2. *Hemerocallideæ* are likewise chiefly remarkable for their showy flowers, as in the garden bulbs, *Hemerocallis*, or Day Lily, *Funkia*, *Agapanthus*, &c. *Polianthes tuberosa* is the fragrant Tuberose. *Phormium tenax*, the New Zealand Flax, and the species of *Sanseviera*, perennial plants with rigid leaves, natives of tropical Africa and India, furnish valuable fibres.

3. The *Aloineæ* are connected with the preceding by the genus *Yucca*, consisting of perennial shrubby plants with hard leaves and a Palm-like, branching stem. The species of *Aloe*, often with highly-coloured flowers, are remarkable for the abundant resinous purgative juice in their succulent foliage.

4. The *Scilleæ* include many beautiful and several very useful plants. Among the former are the species of *Hyacyn-*

thus, Scilla, Ornithogalum (Star of Bethlehem). Among the latter are the various species of *Allium,* such as *A. Cepa,* the Onion; *A. sativum,* Garlic; *A. Porrum,* the Leek; *A. Schœnoprasum,* the Chive; *A. ascalonicum,* the Shallot; and *A. Scorodoprasum,* the Rocambole; *Urginea Scilla,* or *Scilla maritima,* is the medicinal Squill, the bulb being the valuable part.

5. *Anthericeæ.* Many of these have beautiful flowers, and the roots of *Asphodelus, Anthericum,* &c. have active properties.

6. The *Aphyllantheæ* are plants of peculiar habit. The most remarkable are the species of *Xanthorrhœa,* the New Holland Grass-trees, resembling small palms, with a crown of rigid grass-like leaves, and inflorescence somewhat like the club of a bull-rush. They yield an aromatic resinous substance. The buds of some species are eaten by the natives.

80. ASPARAGEÆ.

Asparagus officinalis. The Asparagus plant. A flowering sprig; *fl.* | , a flower cut open perpendicularly.—*Ruscus aculeatus.* Butcher's Broom. A shoot with flowers and fruit. — *Convallaria majalis,* the Lily of the Valley.

This family is usually combined with the Liliaceæ, but as here separated, consists of Lily-like plants with pulpy fruits (berries). Their habit and appearance are exceedingly varied; and while those of temperate climates are small herbs, those of the warmer regions sometimes appear as large trees.

The genus *Convallaria* contains the Lily of the Valley (*C. majalis*), Solomon's Seal (*C. Polygonatum*), common in gardens; these have subterraneous, more or less thickened root-stocks; their juices are acrid. *Ruscus* is a genus of shrubby evergreen plants, the apparent foliage of which consists really of leaf-like branches, bearing the flowers an berries in the middle of the upper face of the leaf-shaped peduncles. *Ruscus aculeatus,* Butcher's Broom, is common in woods in Britain. It has bitter, somewhat acrid juice, possessed, it is said, of active medicinal properties. *Asparagus,* again, consists of almost leafless plants, the apparent foliage being represented by a very much ramified flowering stem. The edible portion consists of the very young succulent flower-stems, before they have become branched and strengthened by wood fibre. The cultivated species, *A. officinalis,* grows wild on sea-cliffs.

Cordyline Ti is a strange tropical plant with long, woody roots (?), eaten, baked, by the Sandwich Islanders; its juice is fermented into a beverage, and its leaves are used for thatching huts, &c. The genus *Dracæna* consists of large trees of branched habit, externally resembling Dicotyledons, and indeed having a separable bark, which is increased in thickness by layers. *Dracæna Draco* is the celebrated Dragon-tree of Teneriffe; some specimens exist 75 feet high and more than 40 feet in circumference. One is known to have been an old tree in the year 1406. This tree yields a resin of astringent character, called Dragon's Blood.

81. MELANTHACEÆ.

This is an order of plants possessing more or less acrid properties, consisting of herbs with bulbs, corms, or tufted fibrous roots, often with broad leaves. The flowers have a perianth composed of 6 segments, either free or confluent into a tube below. The 6 stamens have the anthers *extrorse.* Ovary 3-celled, superior; fruit a dry 3-celled capsule.

These plants occur chiefly in northern latitudes; several of them have important medicinal properties. *Colchicum autumnale,* the Meadow Saffron, is abundant in some parts of England. Its leaves appear in spring, and wither before the flower arises from the ground in autumn; the fruit emerges in the succeeding spring. The solid bulbs and the seeds furnish the Colchicum used in medicine.—*Veratrum album,* called White Hellebore, *V. Sabadilla,* and *Asagræa officinalis,* a Mexican plant, contain a powerful substance called Veratria. Several of the Melanthaceæ have pretty flowers, and are hence cultivated in collections of bulbs.

82. DIOSCOREACEÆ.

Dioscorea sativa. The Yam plant. Part of a shoot, with leaves and blossom. *fr.* two fruits; *fr.* —, a fruit cut across; *s.* seeds.

This and the succeeding family are remarkable among the Monocotyledons for the reticulated arrangement of the veins of their leaves, and for the regular arrangement of the wood of their stems. The latter, however, do not grow by a cambium-layer like those of Dicotyledons.

The Dioscoreaceæ generally produce tubers, fleshy or woody, below or above ground, from which arise slender climbing stems with leaves usually placed alternately, and spikes of small green flowers, possessing bracts, and imperfect. The perianth is composed of 2 rows of segments, 3 in each, adherent to the ovary in the fertile flowers. The 6 stamens are inserted on the base of the perianth. The ovary, inferior, is 3-celled, crowned with a trifid stigma. The fruit is either dry, 3-celled, or with 2 cells abortive; or a fleshy berry.

These plants are chiefly tropical, but one species grows wild in England, *Tamus communis*, or Black Bryony. This produces a thick, fleshy subterraneous tuber, which contains an acrid juice, but also abundance of starch. The tropical vegetables called Yams are the similar tubers of various species of *Dioscorea*—*D. sativa*, *alata*, *aculeata*, &c. which are valuable for the starch they contain. The acrid juices associated here are removed by boiling. *Testudinaria elephantipes*, the Elephant's Foot, produces a remarkable tuberculated woody mass above ground, representing the tuber of the yam, and sending off slender climbing stems; the centre of this mass is eaten by the natives at the Cape of Good Hope.

83. SMILACEÆ.

Smilax papyracea. A Sarsaparilla plant. A shoot with leaves and bunch of fruit.

The Smilaceæ are herbs or shrubby plants, with stalked, netted-veined leaves. They possess a creeping subterraneous rhizome, from which the leafy, often climbing, stems arise.

The flowers are sometimes perfect, sometimes imperfect: the perianth of 6 segments in 2 rows. Stamens 6, on the receptacle or the perianth. Ovary superior, 3-celled. Fruit a berry.

The plants of this family are found in temperate and tropical climates; several of them are esteemed for medical properties, the subsance called Sarsaparilla being the rhizome of various species of *Smilax*. *Smilax aspera,* a native of the South of Europe, is sometimes cultivated as a hardy climber.

84. HYDROCHARIDACEÆ.

An order of aquatic plants, with submerged or floating leaves, with perfect or imperfect flowers, the perianth having 3 green segments and an inner circle of 3 coloured parts. The plants of this family are well known to microscopists from their affording great facilities for the observation of circulation in the cellules, under the microscope. Among these are *Vallisneria spiralis*, *Anacharis Alsinastrum,* with *Stratiotes aloides,* called the Water-soldier, and *Hydrocharis Morsus-ranæ,* a floating plant common in ditches.

85. COMMELYNACEÆ.

An order of herbaceous plants with somewhat solid stems, with sheathing leaves, often arising from fleshy rhizomes; the perianth is composed of a distinct green calyx of 3 sepals, and a coloured corolla of 3 petals. Stamens 6 or fewer, introrse. Ovary 3-celled, style 1.

Commelyna and *Tradescantia* are well known in cultivation; the latter are hardy herbaceous plants, called Spider-worts, from the mode in which the leaves and bracts spread from the stem.

86. JUNCACEÆ.

The Rush order is distinguished by the peculiar fistular, flat or grooved leaves, arising from hard, creeping rhizomes, and the usually scaly flowers, the perianth being composed of 6 greenish or brownish dry segments. Stamens 6 or 3; ovary 3- or 1-celled, style 1, stigmas often 3.

The species of Rush (*Juncus*) are mostly found in cold or temperate climates, in wet places; the *Luzulæ* mostly in woods.

Some of them are supposed to possess medicinal properties.

87. ALISMACEÆ.

The order is composed of a small number of herbaceous plants, growing in or about water, sometimes with broad leaves. The perianth is composed of 2 circles, calyx and corolla, each of 3 parts, the inner petaloid. They have several 1-celled ovaries.

To this family belong several well-known weeds, growing on the banks and in the mud of pools and rivers; such as the Arrow-head (*Sagittaria sagittifolia*), *Alisma*, &c.

88. BUTOMACEÆ.

These plants are also aquatic. *Butomus umbellatus*, called the Flowering Rush, is a pretty plant, common in similar situations to *Alismaceæ*. It has 9 stamens.

SPADICIFLORÆ.

89. Pandanaceæ.
90. Typhaceæ.
91. Palmaceæ.
92. Araceæ.
93. Acoraceæ.
94. Lemnaceæ.
95. Naiadaceæ.

89. PANDANACEÆ.

Pandanus littoralis. The Screw-pine. An entire tree; *fr.* a ripe fruit.—*Freycinetia strobilacea*, a blossom cut perpendicularly.

These are remarkable trees or shrubby plants, with a branched stem, the roots and leaves of which arise in a curiously regular spiral order, whence the name of Screw-pines.

The flowers are imperfect, on a spadix enclosed in a spathe; with no perianth, or only a few scales. They are tropical plants; some have edible seeds, while the juice of others (*Nipa*) is capable of being fermented.

90. TYPHACEÆ.

The Bulrush order, consists of herbaceous plants with creeping rhizomes, growing in ditches, &c. The stem are free from knots, and bear rigid, sword-shaped leaves, and club-like or globose spadices crowned with staminate and pistillate flowers, with a scaly or hairy perianth. The Bulrushes or Reed-maces (*Typha latifolia* and *angustifolia*) have starchy rhizomes. The abundant pollen of some kinds is used for food in Northern India and in New Zealand. The rhizome of *Sparganium ramosum*, common Bur-reed, is curiously branched.

91. PALMACEÆ.

Hyphæne thebaica. The Egyptian Doum-palm. — *Chamærops humilis.* The Dwarf-palm of the South of Europe, &c. — *Cocos nucifera.* The Cocoa-nut-palm. — *Phœnix dactylifera.* The Date-palm. *p.* pistils. *fl.* ♂, a barren flower; *fr.* a bunch of fruit; *fr.* |, a fruit cut open vertically, to show the seed (stone). — *Elais guineensis.* An Oil-palm of the African coast. — *Ceroxylon andicola.* The South American Wax-palm.

This is the most remarkable of the Monocotyledonous orders as regards size, consisting of trees, with a woody, simple, or occasionally branched trunk, crowned by a cluster of leaves, pinnate or palmate, which leave scars upon the trunk when they fall; these markings being either spirally ranged cicatrices, projections consisting of the bases of the leaf-stalks, or rings giving the stem a jointed appearance. The flowers are borne on simple or branched spadices, enclosed at first in a spathe composed of one or more pieces. The flowers are perfect or imperfect, composed of 2 circles of 3 parts, not greatly developed. The stamens are usually 6 in number, sometimes 3, sometimes numerous. The ovary is 1—3-celled, with a single ovule in each cell. Very often only one ovule and cell become developed, the others being obliterated in the fruit; which is either a nut with a shell surrounded by a pulpy or a fibrous envelope, or it is a berry.

The Palms are mostly tropical plants, one outlier occurring in Europe, another in North America. The uses of the family are very numerous; they supply among them almost every kind of vegetable product important to man—fruits, timber, fibres, starch, sugar, oil, wax, &c.

The Date-palm (*Phœnix dactylifera*), is a native of northern Africa. The fruits of this tree are most important to the inhabitants where it grows, a large proportion of the people, and even of the animals, being chiefly fed on them in some countries of Africa. Many varieties exist.

The Doum-palm (*Hyphæne thebaica*), is one of the few branched palm-trees. This is also a native of North Africa, and its succulent fruit is eaten.

The Cocoa-nut palm (*Cocos nucifera*), is cultivated in all parts of the tropics. The nuts have a hollow albumen (the edible part), which yields a solid oil, extensively used for the same purposes as animal tallow. The timber is known under the name of Porcupine-wood. The fibres of the husk are largely used under the name of Coir, for ropes, matting, &c., being very durable. The nut-shells are converted into utensils. The juice obtained by slicing the flower-stalk is called toddy; this is distilled into Arrack, and also boiled down to extract the sugar. The Seychelles-palm (*Lodoicea seychellarum*), yields the curious double Cocoa-nut.

Mauritia vinifera and *M. flexuosa*, South American palms, yield a kind of palm-wine. The natives live on rafts, suspended between the Mauritia-palms, in the flood-seasons.

Various species of *Sagus* have the centre of the stem soft and full of starch; this is Sago. *S. Rumphii* is the Sago-palm of Malacca. *Saguerus saccharifera* is another Sago-palm, which also yields a saccharine juice, and furnishes the fibres called Gommuti.

Metroxylon læve yields sago in Borneo and Sumatra.

The terminal bud of *Euterpe montana*, the Mountain

Cabbage-palm, is boiled and eaten as a vegetable, as is also that of *Areca oleracea,* the West India Cabbage-palm.

Caryota urens yields abundance of sugar, and the fermentable juice called toddy.

The *Areca Catechu* yields the Betel-nut, chewed, in Hindostan, with the leaves of the betel-pepper.

Attala funifera furnishes the Coquillo-nuts, hard brown nuts used by turners for door-handles, &c. Its fibre is also manufactured.

Phytelephas macrocarpa yields the Vegetable Ivory or Tagua-nut, the vegetable ivory being the horny albumen of the seed.

Elais guineensis and *melanococca* are the African Oil-palms; the solid yellow oil is obtained from the fruits.

Ceroxylon andicola, a South American palm, yields a wax, which exudes on the surface of the stem.

The stems of various species of *Calamus* furnish common Canes, other species the Partridge cane.

Leopoldinia piassaba, a South American palm, furnishes the Piassaba fibre.

Most of the other Palms have analogous valuable qualities.

92. ARACEÆ.

Arum maculatum. The spotted Arum, or Cuckoo-pint. An entire plant; *inf.* the base of the spathe cut open, to show the staminate and pistillate flowers; *fr.* the ripe fruit.

This order consists, in temperate climates, of herbs with a fleshy rhizome or corm; in the tropics often of climbing plants with large adventitious aerial roots. The leaves, sheathing at the base, are often furnished with ramified veins, sometimes compound. Flowers sometimes on a spadix, generally enclosed in a spathe, which is either green or petaloid. Perianth wanting; stamens definite or indefinite; anthers extrorse, 1—4 or more-celled; ovary with 1 or more cells; fruits succulent.

These plants abound most in warm climates, and are characterised by acrid, often poisonous juices, while the rhizomes contain wholesome starch, which may be purified by washing.

The common wild *Arum maculatum,* Cuckoo-pint or Wake-Robin, has a starchy corm. The fecula is sometimes extracted, and sold under the name of Portland Arrow-root. Other kinds of *Arum* emit a very offensive smell when flowering, and heat is evolved at the same time. *Richardia æthiopica* is the plant commonly cultivated in greenhouses under the name of Trumpet-lily. The species of *Colocasia* have edible corms, and are found in many parts of the world, as also some species of *Caladium,* while *Dieffenbachia seguina,* a West Indian plant, is called the Dumb-cane, as it causes the tongue to swell when chewed.

Many of the *Araceæ* are cultivated in stoves.

93. ACORACEÆ.

This order, represented with us by the *Acorus Calamus*, or Sweet Flag, differs from the Araceæ chiefly in the presence of a scaly perianth and in the flower being perfect.

94. LEMNACEÆ.

These are minute plants floating in water, with leaf-like lobes representing the stems, from which descend the pendulous simple rootlets. One or two flowers grow upon these lobes (under the margin in *Lemna*), enclosed in a small spathe, but without a perianth. Several species of *Lemna* constitute the Duckweeds, coating ponds everywhere in this country; *Pistia* and other genera occur in warm climates.

95. NAIADACEÆ.

Potamogeton natans. Broad-leaved Pond-weed. A shoot with leaves and blossom; *fl.* a detached blossom.—*Zannichellia palustris.* Horned Pond-weed. A leafy shoot; *fl.* a detached flower; *fr.* a fruit; *a.* one of the pods opened to show the seed; *a.* |, the lower part of the same with the seed cut open perpendicularly.

Aquatic plants growing in fresh or salt water, floating or submerged, bearing inconspicuous spikes of flowers, perfect or imperfect. Perianth wanting, or of 1—4 scales, stamens definite, on the receptacle. Ovary free, celled, style simple, or 2—3-cleft. Fruit dry, indehiscent, 1-celled, and usually 1-seeded.

These plants are found in all climates. The species of *Potamogeton* or Pond-weed abound in pools and rivers. *Ouvirandra fenestralis,* is so called from its leaves being as it were latticed, consisting of a skeleton of ribs with the interstices open. *Zostera,* Sea-wrack, is common, producing very long narrow riband-like leaves; its flowers are enclosed in herbaceous spathes.

GLUMOIDEÆ.

96. Cyperaceæ. 97. Graminaceæ.

96. CYPERACEÆ.

Carex riparia. Great Common Sedge. A stem with barren and fertile inflorescence; +, part of a stem with leaf-sheath; *fl.* ♂, a barren (staminate) flower; *fl.* ♀, a fertile (pistillate) flower. — *Cyperus longus.* Galingale. Inflorescence; *a.* a spike; *fl.* ♂, a barren (staminate) flower; *p.* pistil.

The sedges consist of herbaceous plants of tufted growth, with grass-like leaves, and solid and frequently angular stems, distinguished readily from the grasses by the tubular sheaths of the leaves not being split down. The flowers are perfect or imperfect, contained in the axils of single bracts arranged in a spike. Perianth wanting, or represented in the pistillate flowers by a membranous envelope around the ovary. Stamens definite, from 1—12, most commonly 3, inserted on the receptacle. Ovary superior, with 1 ovule, frequently surrounded by bristles. Style rough, 2—3-cleft above. Fruit a hard achene, with the embryo in the base of the solitary seed.

The sedges are universally diffused, generally abounding in damp places. Some are tonic and astringent, but their uses chiefly depend on the stems and leaves, furnishing materials for mats, baskets, &c., and paper.

The pith of the Papyrus plant, *Papyrus antiquorum,* furnished the material for the first paper. Its stems and those of other species are used for making mats, &c. in the East. The stems of the species of *Scirpus* are used like rushes for matting, baskets, chair-seats, &c. The leaves of the Cotton-grasses, species of *Eriophorum,* are sometimes used for stuffing cushions.

Cyperus longus, English Galingale, has tonic and astringent rhizomes.

Carex arenaria, incurva, and other species are very useful, in company with certain grasses, on sandy sea-coasts, their creeping rhizomes binding together the shifting sand.

97. GRAMINACEÆ.

Phleum pratense. Cat's-tail grass. *Inf.* a spike of blossom with a leaf and stem behind; *fl.* a flower detached from the spike; *g.* the glumes. — *Poa pratensis.* Meadow Grass. A panicle of inflorescence; on the left a spikelet; *fl.* a flower. — *Hordeum distichum.* Barley. A spike of inflorescence; *fl.* a spikelet of flowers. — *Panicum italicum.* Millet. A spike of inflorescence; *fl.* a spikelet. — *Avena Sativa.* Oat. A panicle of inflorescence; *fl.* a flower. — *Triticum vulgare.* Wheat. A spike of inflorescence; *fl.* a spikelet. — *Oryza sativa.* Rice. A panicle of inflorescence with a leaf; *fl.* spikelets; *fl.* +, a single flower.— *Zea Mays.* Maize or Indian Corn. A stem with barren (♂) and fertile (♀) spikes; *fr.* a spike of fruit. — *Saccharum officinarum.* Sugar Cane. The upper part of a stem with inflorescence; *a.* a portion of the stem; *fl.* +; spikelets; *fl. fl.* flowers.

The Grasses, constituting one of the most valuable families of plants, are mostly low herbs, but some of the tropical kinds are arborescent. There is a general distinction between the more common grasses of cool moist climates, and those of hot dry regions, that the former produces a verdant even turf, while the latter are more tufted and rigid in their character.

The erect stems are round, commonly hollow, with knots or joints at intervals; they even in many perennial kinds form creeping subterraneous rhizomes. The leaves are mostly narrow, long, and alternately placed, with a tubular sheathing base, slit down on the side of the stem opposite to that where the blade passes off; the blade is often connected with the stem by a little band called the ligule. The flowers are either perfect or imperfect, solitary or arranged in spikelets conjoined into spikes or panicles. The spikelets are generally enclosed at the base by usually 2 (sometimes only 1) foliaceous scales, called glumes; the flowers of the spikelet are each surrounded by a kind of calyx, ordinarily composed of two foliaceous or membranous scales, called pales, of which the outer, rather lower down on the receptacle, is simple, the inner or upper apparently double, and supposed to consist of 2 blended pales. The inner and sometimes both are wanting in some grasses. The stamens are usually 3, but sometimes 1—6, hypogynous, with versatile anthers. Ovary superior, 1-celled, 1-ovuled, styles 2 or 3, in some cases united; outside the ovary are often 1 or 2 hypogynous scales. Fruit a dry seed-like body, chiefly composed of the single seed, which has the embryo on one side at the bottom.

The grasses are universally distributed, and a vast number of species are known. Among the most important are the Cereal grasses or Corn-plants, but many of them are very valuable for fodder, for producing sugar, or materials for manufactures of different kinds.

The chief corn-plants of temperate regions are the different kinds of Wheat (*Triticum vulgare* and its varieties); Barley, (*Hordeum distichum*), &c.; Oats (*Avena sativa*); Rye (*Secale cereale*). The corns of various climates are—Rice (*Oryza sativa*), Maize or Indian Corn (*Zea Mays*), together with various Millets (*Panicum miliaceum, Sorghum vulgare, Andropogon Sorghum*), &c.

Cane sugar is extracted from *Saccharum officinarum*, the Sugar-cane; also in less quantity in Brazil from *Gynerium saccharoides*, in Africa from *Sorghum saccharatum.*

The Bamboo-canes, as they are called, are the stems of arborescent grasses, *Bambusa arundinacea* and other species. *Arundo Phragmites* and other species, furnish Reeds.

Andropogon Schœnanthus, Lemon-grass, and other East-Indian species, yield a fragrant oil. The rhizomes of *Anatherum muricatum* constitute the perfume called Vetivert. The hard seeds of *Coix Lachryma*, Job's tears, are used for beads.

Very many species are included among the ordinary fodder grasses, such as species of *Poa, Festuca, Dactylis, Bromus,* &c. *Dactylis cæspitosa* is the Tussac-grass of the Falkland Islands. The grain called Canary-seed is yielded by *Phalaris canariensis,* a variegated variety of which constitutes the striped grass commonly cultivated in gardens.

GYMNOSPERMIA.

98. Coniferæ. 99. Cycadaceæ.

98. CONIFERÆ.

Abies excelsa. The Norway Spruce Fir. *fr.* a ripe cone. — *Cedrus Libani.* The Cedar of Lebanon. *fr.* a ripe cone. — *Pinus sylvestris.* The Scotch Fir. *fl.* scale from a cone; *p.* open carpel with two ovules; *s.* a ripe winged seed.— *Larix europœa.* The Larch-tree. Below a shoot with barren (♂) and fertile (♀) immature cones; below this a twig bearing tufts of leaves; *fr.* a ripe cone.— *Cupressus sempervirens.* The Cypress-tree. *inf.* a shoot with inflorescence; ♂, a barren (staminate) inflorescence; *fr.* a ripe cone. — *Taxus communis.* The Yew-tree. *inf.* a shoot with inflorescence; ♂, a barren (staminate) flower; ♀, a fertile flower; *fr.* a young fruit; *fr.* +, a ripe fruit (berry).

The Coniferæ are distinguished from the Cycadaceæ very readily by their habit, being branched trees or shrubs, with simple leaves, and a growth like that of the Dicotyledons. They are commonly divided into three families.

1. PINACEÆ. Stems continuous, leaves needle-like; fertile flowers in cones.

2. TAXACEÆ. Stems continuous, leaves often forked-veined, fertile flowers solitary.

3. GNETACEÆ. Stems jointed, leaves netted-veined, anthers 1-celled, opening by pores.

1. The *Pinaceæ.* These are resinous trees or shrubs, with hard evergreen leaves, sometimes clustered and enclosed at the base in a membranous sheath. Flowers imperfect and destitute of perianth. Barren flowers in deciduous cones, each flower composed of one or several united scale-like anthers; anthers 2- or many-celled, splitting longitudinally.

Fertile flowers in persistent cones, each composed of scale-like carpels arising in the axil of a membranous bract; ovules 1—2 or several, at the base of the scale, naked. Fruit, a cone composed of the scales converted into woody plates or wedge-shaped segments.

The *Abietineæ*, or Firs characterised by inverted ovules, are separated from the *Cupressineæ*, with erect ovules. The Pinaceæ are universally distributed, but are especially characteristic as forest-trees of northern or alpine climates. In the northern hemisphere the species of *Pinus, Abies, Juniperus,* &c. are most developed; in the southern those of *Araucaria, Dammara,* &c.

The Abietineæ comprehend a large number of most valuable trees; thus, of the genus *Pinus* we have—*P. sylvestris,* the Scotch fir; *P. Pinaster,* the Cluster-pine; *P. palustris,* the Virginian swamp-pine; *P. Tæda,* the Frankincense-pine: all these furnish, besides timber, pitch and turpentine. *P. Pinea,* the Stone-pine, has edible seeds; and with *P. halepensis,* the Aleppo-pine, is used for ship-building in the South of Europe. *P. Pumilio* yields Hungarian balsam. *Pinus Lambertiania, P. Strobus* and others attain a height of more than 200 feet. Among the species of *Abies,* Firs and Spruces, are *A. excelsa,* Norway spruce; A. *pectinata,* the Silver fir (which furnishes the Strasburg turpentine); A. *canadensis,* the Hemlock spruce (yielding Canada balsam); A. *balsamea,* the Balm of Gilead fir. A. *Douglasii, grandis, alba,* &c. attain enormous dimensions. *Cedrus Libani* is the Cedar of Lebanon, a magnificent tree; *C. Deodara,* the Deodar or Himalayan Cedar, is supposed to be only a variety of this. The wood is very durable. *Larix europea,* the Larch, yields valuable timber, and also Venice turpentine. *Araucaria* includes large trees from Chili and Australia, especially *A. imbricata* (Chili), *A. Bidwelli,* and *A. Cunninghami* from Moreton Bay; the seeds of *A. Bidwelli* are eaten. *Eutassa excelsa* is the celebrated Norfolk Island pine. *Dammara australis* is the Kawrie pine of New Zealand, very valuable for masts; it yields an important resin;—the resin of *D. orientalis,* an East Indian species, furnishes gum Dammar, largely used in the manufacture of varnish.

Of the *Cupressineæ*, the genus *Juniperus* includes many valuable timber-trees and resinous plants. What is commonly called Cedar by cabinet-makers and the manufacturers of lead-pencils, is the wood of *J. bermudiana* and *virginiana*. *J. Oxycedrus*, a South European kind, has a valuable wood. *J. communis* is the common Juniper, the berries of which are used to flavour spirits; the wood is also used for veneering. *J. Sabina*, the Savine, possesses active and dangerous properties in the leaves and shoots. *Cupressus sempervirens* is the common Cypress; its wood is very lasting. *Cryptomeria japonica* is the Japan cedar. *Taxodium distichum*, the North American deciduous Cypress, grows to a large size; it grows in the celebrated cypress swamps of the Southern states. *Thuja* includes the two kinds of Arbor-vitæ, *T. orientalis* and *T. occidentalis*; *T. gigantea*, a South American kind, grows to nearly 200 feet high. *Callitris quadrivalvis*, a North African tree, has aromatic and durable wood. Many species grow in Australia; *C. australis* is the Oyster Bay pine.

2. *Taxaceæ*. This family consists of trees with evergreen, usually narrow, leaves, alternate or in two ranks. The barren flowers are surrounded by bracts arranged in a kind of cone, the flowers themselves consisting of several stamens with the filaments usually united, the anthers united or distinct, bursting by slits. The fertile flowers consist of a solitary naked ovule, surrounded by imbricated scales. The seed is usually supported or surrounded by a succulent pericarp.

The Taxaceæ, like the Pinaceæ, are universally diffused, and their properties are similar. *Taxus baccata*, the Yew-tree, has a very durable wood; its fruit is succulent, forming a kind of berry; the leaves and seeds are poisonous. The species of *Dacrydium*, *D. Franklinii*, the Huon Pine of Australia, *D. cupressinum*, the Dimon Pine, and *D. taxifolium*, the Kakaterro of New Zealand, are valuable timber-trees. *Podocarpus Totarra*, *P. dacrydioides*, *P. spicata*, and *P. fer-*

ruginia are all valuable timber-trees in New Zealand. *Salisburia adiantifolia,* the Gingko, is a curious tree with leaves having the forms and venation of those of a Fern; its fruit is succulent, about as large as a damson, of astringent quality.

3. *Gnetaceæ.* Small trees or shrubs with jointed stems, and reticulated, sometimes scaly leaves. They are called Joint Firs. The genera *Ephedra* and *Gnetum* compose this family. The former has various species in temperate climates; the species of *Gnetum* occur in the tropics.

99. CYCADACEÆ.

Cycas circinalis. **A Moluccese tree yielding starch. — *Ceratozamia mexicana.* A young plant with a cone. ♂, a barren cone of staminate scales; ♀, a fertile cone of peltate scales bearing ovules underneath.**

The plants of this order are distinguished from the Coniferæ by the stems resembling those of Palms, being usually simple, and crowned by a large tuft of pinnate, rigid leaves. The stems are sometimes forked, like those of certain palms, and they are densely set with the scars of the fallen leaves; the latter are usually rolled in scrolls in the bud. The imperfect flowers are devoid of perianth, and collected in cones. The barren cones are composed of scales with clusters of 1-celled anthers. The fertile cones are composed of flat scales bearing naked ovules on their margins, or at the base, or shield-shaped stalked scales, with the ovules underneath. Seeds either hard or with a soft pulpy coat.

The Cycadaceæ are chiefly tropical, and they are most remarkable for the starch contained by some kinds. *Cycas revoluta,* in Japan, and *C. circinalis* in the Moluccas, serve as Sago plants. *Dion edule,* a Mexican kind, has starchy seeds. Some species of *Zamia* furnish a kind of Arrow-root in Mexico, and species of *Encephalartos* yield "Caffir-bread" at the Cape of Good Hope. Trunks of trees of the *Cycas* kind occur fossil in Britain.

CRYPTOGAMIA.

ACROGENS.

LYCOPODALES.

100. Marsileaceæ.
101. Lycopodiaceæ.

FILICALES.

102. Polypodiaceæ.
103. Ophioglossaceæ.
104. Equisetaceæ.

BRYALES.

105. Muscaceæ.
106. Hepaticaceæ.

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107. Characeæ.

100. Marsileaceæ.

Marsilea quadrifolia. An entire plant, bearing capsules of fruit. — *Pilularia globulifera.* Pill-wort. An entire plant with capsules of fruit; *fr.* | , a capsule cut open perpendicularly; *fr.*—, a capsule cut across.

This small order of aquatic flowerless plants is chiefly interesting in a physiological point of view, on account of the mode of germination of the spores. The plants are of small size, creeping in mud or floating on water, with broad or grass-like leaves, and capsules of fruit arising near the bases of these. Sometimes the capsules contain both large and small spores, sometimes these occur in separate capsules. The large spores represent ovules, the smaller pollen. *Pilularia* is found in Britain; *Marsilea* and *Salvinia* are natives of temperate and warm climates. *Azolla* has species in America, the East Indies, and in Australia.

101. Lycopodiaceæ.

Lycopodium cernuum. Nodding Club-moss. — *Lycopodium clavatum.* Common Club-moss. Part of a creeping stem with spikes of fruit; *fr.* scales bearing sporanges; *l.* ordinary leaves; *s.* sporange.

The Club-mosses and their allies vary much in outward character, *Lycopodium* having creeping stems closely covered with scale-like green leaves of hard texture, and stalked spikes of fruit; or, in the division often distinguished as *Selaginellæ*, (*L. cernuum*, *&c.*), with delicate green leaves, and spore-cases in the axils of scales, or sessile spikes formed out of the ordinary branches; *Isoëtes* has a woody corm or tuberous stem, and a tuft of erect filiform leaves, in the bases of which the spore-cases are immersed. The spore-cases are little axillary capsules containing either many small spores or few large spores. Both kinds of spore occur in *Isoëtes* and *Selaginella*, but only the small kind has been found in the true *Lycopodia*. The small spores do not germinate, but represent pollen; the large represent ovules, and produce new plants.

A number of the true *Lycopodia* are found in Britain, chiefly on mountains, but only one of the *Selaginellæ*, which however are abundant in the East Indian islands, and are now much cultivated in stoves and fern-cases, on account of the great beauty of their foliage. *Isoëtes* has one British species growing in mountain lakes.

The spores of *L. clavatum*, forming a very light yellowish powder, very inflammable, were formerly used under the name of vegetable brimstone in pyrotechny, also for coating pills. *L. catharticum* is said to possess very active properties.

102. POLYPODIACEÆ.

Alsophila armata. A Tree-fern, with an enlarged view of a piece of a trunk and of a terminal bud. — *Aspidium Filix-mas.* Male-fern. A leaf arising from a creeping rhizome or rootstock; *l.* part of a leaflet showing the fruit-heaps (sori) covered by their indusia; *c.* theca or capsule from a sorus; *s.* spores from a capsule. — *Polypodium vulgare.* Common Polypody or Oak-fern. Two leaves springing from a creeping rootstock, one bearing fruit; *l.* leaflets with sori; *fr.* part of a leaflet with two sori magnified. — *Osmunda regalis.* Royal-fern. The upper part of a leaf with fructification at the summit; *fr.* cluster of capsules from the fructification, magnified.

The Ferns are characterised among the flowerless plants by the great development of the leaves; a large proportion of them are herbs, but in the tropics and the islands of the South Ocean they produce tall trunks, and become Tree-ferns. The herbaceous kinds have an erect or horizontal rhizome, from which the leaves arise closely or at intervals; the trees are crowned with a bunch of leaves, like a palm—in both cases the leaves unroll from a scroll-shaped rudiment. The leaves are more or less strongly ribbed, and on these ribs, at the back of perfect leaves, or on metamorphosed special fruit-leaves, appear the *sori,* little collections of capsules, naked or covered by an indusium, these capsules containing the spores.

The Polypodiaceæ may be divided into 3 sections:—

1. POLYPODIACEÆ proper. Sori on the backs of the leaves, composed of capsules with a vertical annulus.

2. HYMENOPHYLLACEÆ. Sori in receptacles at the margin of the leaves, containing capsules with an oblique ring inserted on a central column prolonged from a vein of the leaf.

3. MARATTIACEÆ. Sori on the backs of the leaves, composed of capsules with a cap-like annulus on the top combined together into masses.

4. OSMUNDACEÆ. Sori on the ribs of metamorphosed lobes of the leaves, composed of capsules with an imperfect annulus.

1. The *Polypodiaceæ* include a vast number of plants, many with exceedingly beautiful foliage, occurring in all parts of the globe. The rhizomes of a few are used for food in some parts of the world, as that of *Pteris esculenta* by the New Zealanders, &c. *Adiantum Capillus-Veneris,* Maiden-hair Fern, a beautiful species, gives its name to Capillaire, a syrup flavoured with it. The rhizome of the Male-fern (*Aspidium* or *Lastræa Filix-mas*) has medicinal properties. Most of the tree-ferns belong to this section.

2. The Filmy Ferns are of exceedingly delicate and elegant structure. Two species of *Hymenophyllum* and one of *Trichomanes* occur in England and the South of Ireland, but most of the species belong to damp tropical regions.

3. The *Marattiaceæ* are natives of warm climates, a few are arborescent. The rhizomes of *Marattia alata* are eaten in the Sandwich Islands in times of scarcity.

4. The *Osmundaceæ,* or Flowering Ferns, as they are often

called from the separate development of their sporangial leaves, are few in number, but mostly of large size. The *Osmunda regalis*, "Royal" or "Osmund's" Fern, is found in boggy places in many parts of Britain.

Remains of Ferns occur abundantly in a fossil condition, especially in the rocks of the coal period.

103. OPHIOGLOSSACEÆ.

Botrychium Lunaria. Moon-wort. An entire plant; *fr.* a portion of the fruit-lobe of the leaf magnified. — *Ophioglossum vulgatum.* Adder's tongue. A plant cut off level with the earth; *fr.* the fruit-spike or fertile lobe of the leaf.

The Ophioglossaceæ are inconspicuous herbs, found in temperate climates, in the Asiatic islands, and in the West Indies. They are chiefly remarkable for their peculiar structure, the fertile lobes of the leaves being converted into spikes or racemes of capsules, opening by two valves, somewhat like those of *Osmunda*, but without any annulus. The general structure is like that of many Polypodiaceæ, but they have more or less developed perennial corms, and an erect annual stem which dies to the ground in autumn. Adder's Tongue (*Ophioglossum vulgatum*), and Moon-wort (*Botrychium Lunaria*), are both found in many parts of Britain, and their peculiar forms led to many occult virtues being attributed to them in days of old.

104. EQUISETACEÆ.

Equisetum arvense. Corn-field Horse-tail. An entire plant with fertile and barren stems; *fr.* | , a fruit-spike cut perpendicularly; *c.* a capsule from the same, magnified; *s.* a highly magnified spore.

The Equisetaceæ or Horse-tails form a very natural family of flowerless plants, remarkably distinguished by the abortive condition of the leaves. They are herbs with creeping subterraneous jointed rhizomes, sending up erect jointed hollow annual stems, simple or several times branched, the branches arising in whorls from the joints, which are surrounded by membranous toothed sheaths, representing the leaves. The fruit consists of clavate terminal spikes, either on all or on special stems; these are composed of little mushroom-shaped scales attached by their stalks, and bearing under the flat head a circle of little pouches containing the spores.

The Horse-tails grow in mud and in water, in all parts of the world. They are characterised by a brittle texture and a dull colour. The epidermis contains much flinty matter, in *E. hyemale*, the Dutch Rush, so much as to render the stems valuable for polishing metals. The British species grow in some cases to four or five feet in height, the tropical to fifteen or sixteen feet. Fossil plants apparently allied to them occur associated with the coal formations; these attained far more considerable dimensions than any existing *Equiseta*.

105. MUSCACEÆ.

Polytrichum commune. Common Hair-moss. Plants with fruit capsules; ♂, a head of antheridia; *c.c.* a capsule with its calyptra or hood; *c.o.* capsules with their opercula or lids.—*Hypnum purum.* Pure Feather-moss. A plant in fruit; *c.o.* a capsule with its operculum; *c.* a capsule with the operculum off, showing the peristome.

This is an order of minute plants ordinarily growing in masses or tufts, on the ground, rocks, trunks of trees, &c., or in water. The foliage consists of small and delicate green leaves which are mostly crowded on thread-like, simple or branched stalks. The spores are produced in urn-like capsules, sessile or stalked, at the ends of the stems, or of lateral branches. The urns or sporages have a cover called the calyptra, also a lid called the operculum, and when this is thrown off there often appear one or two circles of teeth at the mouth, constituting the peristome. In some mosses the capsule does not burst; in others (*Andræa*) it opens at the sides by four slits. The capsules are produced from pistillidia or archegonia after their fertilization by the contents of the antheridia; these organs occur in terminal or axillary bud-like structures.

The Mosses occur in all parts of the world, especially abounding in temperate climates. They are of little use directly, but contribute greatly to promote the extension of vegetable life, being among the active pioneers which soon invade barren spots when moisture is present. The *Sphagna* or Bog-mosses make up a large part of the mass of peat-bogs.

106. HEPATICACEÆ.

Jungermannia complanata. Flat Jungermannia. A plant bearing fruit; *fr.* a fruit capsule unopened; *fr.* +, fruit-capsules open and discharging their spores. — *Marchantia polymorpha.* Variable Liver-wort. ♂, a barren plant with antheridial receptacles; ♀, a fertile plant with archegonial receptacles; *fr.* one of the latter cut perpendicularly to show the capsules; *se.* spores and an elater from a capsule.

The Liverworts and their allies closely resemble the Mosses in many respects, being minute plants of herbaceous habit, sometimes having thread-like stems clothed with small leaves. The cellular texture of the leafy Hepaticaceæ is however more delicate than that of the Mosses, and one division of the order presents a broad leaflike expansion of the stem in place of true leaves. The family is consequently divided into the foliaceous and frondose Liverworts.

1. JUNGERMANNIEÆ. These have creeping delicate leafy stems, from which arise little upright threads bearing oval capsules, which burst into four valves, spreading like a cross, and discharging spores and spiral fibrous threads called elaters. These are sometimes called Scale-mosses.

2. MARCHANTIEÆ. These have lobed green frondose stems, with usually either imbedded fruits or stalked receptacles bearing a number of capsules, bursting in various ways to discharge spores, with or without elaters. These are the true Liverworts. Some float in water.

This family is generally diffused, occurring especially in damp places. It is observed that the Liverworts will vegetate luxuriantly in damp places where the direct sunlight never penetrates, but require sunshine to bring them into fruit.

107. CHARACEÆ.

Chara translucens. Translucent Chara. The top of a branch, with fruits; ♂, a barren fruit or globule; ♀, a fertile fruit or nucule. — *Chara fœtida.*

Stinking Chara. Top of a branch. A piece of a stem cut across; *fr.* fruits in position; ♀, fertile (nucule); ♂, barren (globule)

This is a small order of aquatic plants strongly resembling some of the Algæ, but distinguished by the peculiarity of the fructification. The Charas grow in ditches and ponds, rooting more or less at the bottom. Their branching stems are well-known microscopic objects, showing beautifully the circulation of the cell-sap. The fructification is of two kinds. The globules, supposed to be antheridia, are spherical cases of a red colour, containing groups of filaments from which are discharged very minute ciliated bodies, supposed to fertilize the nucule. The nucule is an oval body covered with a spirally arranged layer of cells; when mature it falls off, and germinates like a seed.

The Charas are generally diffused; they frequently become encrusted with carbonate of lime. Some of them give off a a very fœtid odour when decaying.

CRYPTOGAMIA.

THALLOPHYTES.

FUNGALES.

108. Hymenomycetes.
109. Gasteromycetes.
110. Coniomycetes.
111. Ascomycetes.
112. Hyphomycetes.

LICHENALES.

113. Lichenes.

ALGALES.

114. Fucoideæ.
115. Florideæ.
116. Confervoideæ.
117. Unicellulares.

FUNGALES.

The peculiar distinguishing character of this class is, that the Mycelium or Thallus is an interlaced filamentous structure, growing in liquids or in the interior of decaying animal or vegetable substances, while the fructification is ordinarily elevated into the air. The Fungi are moreover devoid of the characteristic green colouring matter of leaves and shoots. Their construction is ordinarily fleshy, horny or gelatinous. The thallus has the same simple character in all cases; the distinction of the families is therefore based on the mode of production of the spores.

1. HYMENOMYCETES. Spores generally in fours, on distinct sporophores. Hymenium naked.

2. GASTEROMYCETES. Spores generally in fours, on distinct sporophores, or in sacs attached to the hymenium. Hymenium enclosed in a peridium or case.

3. CONIOMYCETES. Spores single, often septate, on more or less distinct sporophores. Fruit-bearing filaments obsolete or mere peduncles.

4. ASCOMYCETES. Spores contained (usually 8 together) in spore-sacs or cases in cup-like or excavated receptacles, ultimately open to the air.

5. HYPHOMYCETES. Spores either naked or in vesicular sporanges, at the free extremities of filaments coming directly from the mycelium. Microscopic.

108. HYMENOMYCETES.

Agaricus campestris. The Common Mushroom. The right-hand figure represents two fruits growing from the mycelium, one a button, the other fully expanded. The left-hand figure represents a fragment from one of the gills bearing four minute spores on the free sporophore. — *Boletus edulis.* Esculent Boletus. A complete fruit, and one sliced perpendicularly to show the tubes taking the place of the gills of the Mushroom.

The best known of these plants are the Agarics, of which the common Mushroom is an example. The thallus of this is represented by the filamentous spawn, from which the complex fruit arises. In *Agaricus* the basidia or sporophores arise from the sides of vertical plates, called the gills. In allied genera, such as *Boletus, Polyporus, Merulius,* &c., the plates are replaced by canals, sinuous slits, spines, &c.; and in some kinds of Hymenomycetes, the flat spore-bearing pileus is sessile, not arising from a stalk. In some of these also the spore-bearing surface is on the upper instead of the under surface of the pileus. The Tremellini are of gelatinous consistence.

Many of the plants of this universally distributed family are edible; many, on the other hand, poisonous. The Mushroom is the only kind commonly eaten in this country, but on the Continent many others are used for food, and in Australia the genus *Boletus* affords very important supplies of food. *Amanita muscaria,* a poisonous kind, is used for producing a kind of intoxication in Kamtschatka. Some species of *Polyporus* are dried and pressed, and used instead of leather for making razor-strops. Others are converted into Amadou or German tinder. The dry-rot fungus is the mycelum of species of *Merulius,* and other genera, creeping through and disorganizing the cellular structure of wood. The fructification is produced on the surface of the infected timber. Some of the Agarics are phosphorescent.

109. GASTEROMYCETES.

Lycoperdon gemmatum. Studded Puff-ball. An entire fruit before it bursts to discharge the spores. — *Tuber cibarium.* The Common Truffle. The lower figure represents a highly magnified section of a part of the flesh of the White Truffle, with cavities containing the spores.

This order contains a very large number of plants, some very large and conspicuous, others very minute mildews, and some growing buried in the earth. They all have a cottony mycelium, bearing fruits of varied form; at first, almost solid, and merely excavated into sinuous cavities lined with sporophores, or sacs containing 4 spores; but ultimately consisting of hollow cases, with a single or double coat, either filled with loose spores and discharging them by bursting, or containing a curiously shaped spongy frame-work, which expands suddenly when the case or peridium bursts, and is found covered in certain parts with the spores collected into a viscid semiliquid mass. This family occurs universally. It contains the Puff-balls of our meadows, the Truffle (*Tuber cibarium*), and other truffle-like subterraneous species, and a large number of often fugacious epiphytic plants of microscopic dimensions. The manner in which the species of *Phallus, Clathrus,* &c. expand the spore-bearing framework when the peridium bursts, is very remarkable. The same thing occurs on a microscopic scale in the Trichogastres, the epiphytic forms. *Phallus, Clathrus,* and their allies emit a very offensive smell when they burst.

110. CONIOMYCETES.

Puccinia Graminis. Grass Mildew. *Fig.* 1. represents a piece of straw infected; *fig.* 2. a small piece of the surface of the same, showing the nature of the black lines; *fig.* 3. two tufts of spores from one of the black lines.

The order established under this name includes a somewhat heterogeneous assemblage of forms, consisting chiefly of Fungi growing upon dead or living plants, especially on the leaves and other herbaceous parts. Some of these are exceedingly noxious, especially the Uredines, constituting the *rusts*, *brands*, &c. of the cereal grains and other cultivated plants; *Puccinia graminis* produces the "blight" or "mildew" of corn; *Uredo segetum*, and other species, the "smut," "brand," "bunt," &c. The mycelium of these plants grows in the interstices of the tissues of the plants infected, living upon their juices; and, finally, the fructification appears in more or less considerable quantity on the surface.

111. ASCOMYCETES.

Peziza abietina. Two perfect fruits. — *Morchella praerosa.* A kind of Morel. The right-hand figure represents a perpendicular section of the other. — *Hysterium Fraxini.* *Fig.* 1 is a portion of Ash-bark with spots of the fungus; *fig.* 2, one of these spots magnified; *fig.* 3, a perpendicular slice through the same, highly magnified; *fig.* 4, a spore-case and filament from the same, still more enlarged.

This order includes two groups, the Pyrenomycetous, or nucleated kind, and the Discomycetous, or expanded kind. In the former the asci line the wall of a receptacle excavated in the substance of the Fungus, usually opened by a pore or slit above. In the latter, the receptacle expands when mature into an open disk or even a pileus clothed with asci containing 8 spores. The general form of the Fungi differs much; some of the Pyrenomycetes have clavate processes with the receptacles accumulated at the ends; others are sessile: they mostly occur on dead vegetable structures, sometimes on animals. The Ergot of rye is a kind of *Sphæria,* or rather *Claviceps* (*C. purpurea*), the fruit of which is developed after the ergoted grain has fallen to the ground. *Sphæria Robertsii* is an Australian kind, very similar, invading the caterpillars of a large moth. The Morel (*Morchella esculenta*) is one of the Discomycetous forms. It is imported in a dry state from Italy. *Pezizæ* and other forms of this group are common on decaying wood, in autumn, in Britain.

112. HYPHOMYCETES.

Mucor Mucedo. Common Paste Mould. The lower figure represents a leaf moulded over, and the upper figures three separate fruits from the same, highly magnified.—*Acrostalagmus cinnabarinus.* Scarlet Mildew, from rotting potatoes. *Fig.* 1, two separate fruits magnified; *fig.* 2, the top of a branch of one of them; *fig.* 3, two vesicles from the preceding, more magnified; *fig.* 4, end of the column inside the above vesicles with two spores *in situ,* very highly magnified.

This order comprehends the various moulds and mildews of decaying vegetable substances. The general character is that of filamentous flocks (mycelium) floating in liquid or growing in soft wet substances, or spreading over the surface of organic matter in a damp atmosphere; the fruit consists of simple or conjoined microscopic filaments, arising from the flocculent mycelium, either simple or branched, bearing at the free ends either naked, single, or conjoined rows of spores, or vesicular cases enclosing a number of exceedingly minute sporules. Among the best known of these plants are the Common Mildew (*Mucor Mucedo*), easily known by its globular sporanges; the blue mould of cheese (*Aspergillus glaucus*), the green *mildew* of decaying vegetable matter (*Penicillium glaucum*), &c. The potato Fungus (*Botrytis destructor*), also belongs here. The mycelium of these plants plays a very important part in the economy of nature, in producing chemical changes in organic matters. The Vinegar plant, which causes the change of sugar into vinegar, is apparently only the mycelium of *Penicillium glaucum;* and there is good reason to believe that the substance called Yeast, by means of which fermentation of bread, of spirituous liquors, &c., is universally brought about is nothing but a particular form of the same vegetable. These Fungi, when of parasitic habit, sometimes produce immense mischief in cultivated plants.

LICHENALES.

113. LICHENES.

Parmelia tiliacea. Lime-tree Shield-lichen. A patch of natural size; *fr.* 1, a perpendicular section of one of the shields; *fr.* 2, a piece of the reproductive stratum lining the cup, showing four sacs containing spores.—*Stereocaulon ramulosum.* Branching Stalk-lichen. A fragment of the plant; *fr.* two fruits magnified.

The Lichens may be ordinarily distinguished by their peculiar texture, the thallus consisting of a scaly, crustaceous, horny or papery expansion, lobed or branched in a bushy manner, seldom possessing the proper green tint of ordinary vegetation, and growing on stones, earth, bark of trees, &c. wholly exposed to the air, from which they derive their nourishment. The fruits are of two kinds, closed or open; the former occur on the branches of the shrubby forms, or as nodules on the flat thallus of some of the encrusting forms. The open fruits appear as stalked or sessile, disk-like, or linear, raised masses, with the fertile surface open to the air. The closed fruits are lined with thecæ, the open fruits bear them on the concave upper surface; the thecæ are long sacs containing usually about 8 spores. In the closed fruits the spores ultimately escape by a pore or by the irregular decay of the summit of the receptacle. In most Lichens a layer of green cells is found enclosed between the papery or horny upper and lower surfaces of the thallus, these are gemmæ or gonidia, and break their way out when the plant is vegetating actively, reproducing the plant like buds.

Many of the Lichens are of considerable importance. They occur in all parts of the world, but their presence is most striking where they form the advanced guard, as it were, of vegetable life, in the higher regions of the loftiest mountains, near the poles, or on barren stony tracts, where there is not yet sufficient soil for more highly organized plants.

Cladonia rangiferina, the Rein-deer moss or Lichen, clothes large tracts in the north, forming in some cases the chief food of the animal whence it derives its name. *Cetraria islandica,* Iceland Moss, contains starch, and together with *C. nivalis* is nutritious, as are also species of *Gyrophora,* which are called by the Canadian Hunters *Tripe de Roche.*

Lecanora tartarea furnishes the dye called Cudbear; *Roccella tinctoria,* from South Europe, the Azores, Canaries, &c., *R. fuciformis* from Africa and South America, furnish the dye called Orchel or Archil. Litmus is obtained from several kinds of *Roccella.*

ALGALES.

This class is distinguished from the nearest allies, Fungi and Lichenes, by the aquatic habit and ordinarily by the soft and continuous cellular texture of the thallus. All grow either wholly in water or in air completely saturated with watery vapour. The larger forms are marine; the smaller, including very numerous microscopic forms, are natives of salt or fresh water, or grow on damp ground, walls, &c. The Algæ are divisible into four groups:—

1. FUCOIDEÆ, or Olive Sea-weeds, marine plants, ordinarily with a well-developed thallus or frond of olive or brownish green colour, with proper spore-fruits.

2. FLORIDEÆ, or Red Sea-weeds; marine plants with a rosy or purple thallus, with proper spores and tetraspores.

3. CONFERVOIDEÆ, or Green Sea-weed and Silk-weeds of fresh water. Green foliaceous or filamentous plants, reproduced by the emission of the contents of the ordinary cells of the frond.

4. UNICELLULARES. Microscopic plants composed each of a single cell, either free or conjoined with others into groups or families.

114. FUCOIDEÆ.

Fucus vesiculosus. Bladder-wrack. The end of a frond with a bladder below and two pairs of pods at the tips of branches; *fr.*— a pod cut across to show the numerous conceptacles it contains; *s.* a sac containing a spore, with several filaments, extracted from one of the conceptacles, and very highly magnified. —*Sargassum vulgare.* Gulf-weed. Fragment of a frond with two stalked air-bladders.

The Fucoids are the largest and strongest of the Sea-weeds, growing usually between tide-marks and in disturbed water, mostly anchored by disks or cord-like processes to rocks and stones; sometimes buoyed up by air-bladders. The fruits of *Fucus* are complicated, consisting of receptacles at the ends of lobes of the frond, having conceptacles or chambers in their walls, opening outward by pores, lined with sacs containing spores and other more delicate sacs containing fertilizing ciliated threads. Other Fucoids are reproduced by zoospores, consisting of microscopic oval bodies, formed from the contents of special cells, moving actively through the water by the help of 2 or 4 cilia when discharged from the parent plant. The fertile cells are arranged in groups and patches of various form upon the surface of the thallus, or imbedded in it.

The Fucoid Algæ strongly attract the attention of all who visit the sea-shore; but those found in distant regions are more remarkable than our native kinds, some of the South American species growing to a length of 200 or 300 feet; the floating bank of Gulf-weed (*Sargassum vulgare*) covers a tract of ocean measured by degrees in the Atlantic. Some of the Algæ are nutritious, such as the *Laminariæ* or Sugar-tangles. Many contain iodine in quantity; this is extracted from the ashes, or Kelp, which was formerly an important source of Soda. The Fucoid Algæ are largely used for manure on the sea-coasts of Britain.

115. FLORIDEÆ.

Plocamium coccineum. Scarlet Rose-tangle. *Fig.* 1, a fragment of a frond; *fig.* 2, a little piece with a spore magnified; *fig.* 3, another piece with tetraspores; 4, a smaller piece from the last, showing the imbedded tetraspores

more magnified; *t.* highly magnified tetraspore; *s.* highly magnified spore.—*Chondrus crispus.* Irish-moss Sea weed. *Fig.* 1, a small frond; 2, a longitudinal; and, 3, a cross section of a frond, magnified; *t.* A tetraspore from the last.

The Florideæ, or Red Sea-weeds, are the most beautiful plants of the Class, both as regards colour and form. They grow usually in deeper and quieter water than the Fucoids. Their fructification exhibits various forms; the spores are produced generally in groups, often contained in cases called conceptacles, attached upon or immersed in the thallus; the tetraspores are linear or globular groups of 4 microscopic vesicles, apparently analogous to the gonidia of Lichens; these are either immersed in or attached on the frond, singly or in groups; sometimes in conceptacles. Antheridia also occur. The Red Sea-weeds are universally distributed; many of them are nutritious, such as *Chondrus crispus*, the Carrageen or Irish Moss of the shops; Dulse, *Rhodymenia palmata*, *Iridæa*, *Gracilaria*, *Porphyra*, &c. Some are naturally imbued with carbonate of lime, giving them a stony consistence; these form the true *Corallines* and *Nullipores*, formerly supposed to be the stocks of polypes.

116. CONFERVOIDEÆ.

Conferva Linum. Flax-like Conferva, or Silk-weed. *Fig.* 1, a tuft of filaments attached to a stone; *fig.* 2, fragments of filaments, highly magnified; *fig.* 3, fragment of a decaying filament, magnified. Fragment of a *Rhizoclonium*, equally magnified.—*Batrachospermum moniliforme.* Beaded Batrachosperm. *Fig.* 1. branch of a frond; *fig.* 2, one of the lateral tufts of the same, more magnified.

The Confervoid Algæ are found on all sea-coasts, mostly adherent to stones, larger Algæ, piles, &c., also in every pool, ditch, brook, or river of fresh water. They are mostly of green colour, and generally consist of mere cellular filaments; *Ulva*, however, forms large, flat, leaf-like plates of semi-gelatinous consistence when wet, membranous when dry; other genera connect this with the filamentous kinds. The reproduction takes place either by the contents of the ordinary cells being discharged in the form of ciliated zoospores, which come to rest and grow up into new fronds; or by resting spores formed perfectly in the cells of the parent in various ways, and escaping by regular fissure or gradual decay of the parent-cell.

These plants are of no use to man, but they form the food of multitudes of aquatic animals. Many of them emit a very offensive odour when decaying; but when living they tend to purify fresh water by their growth. The abundance of oxygen discharged in bright sunshine often buoys them up in slimy frothy masses on the surface of the water in summer.

117. UNICELLULARES.

(All highly magnified.)

FAM. 1. DIATOMACEÆ.

Diatoma vulgare. Common Diatoma, or Brittle-wort. A string of frustules, and one separate seen sideways.

FAM. 2. DESMIDIACEÆ.

Desmidium vulgare. Common Desmidium. Part of a filament, and a separate frustule seen sideways.

FAM. 3. PALMELLACEÆ.

Chlorococcum vulgare. Cells, single or undergoing subdivision into 2 or 4.

FAM. 4. VOLVOCINEÆ.

Gonium pectorale. A family-stock, composed of 16 zoospores.

These plants are altogether microscopic, being only visible in masses to the naked eye.

1. The DIATOMACEÆ are cells of angular, geometrical or irregular forms, with a siliceous coat resisting fire and acids, and brown contents, occurring in fresh and salt water.

2. The DESMIDIACEÆ are membranous cells of analogous forms, usually presenting two symmetrical halves, of green colour, mostly collected in definite groups, growing at the bottom of still fresh water.

3. The PALMELLACEÆ mostly form green, sometimes red slimy masses on damp stones, &c., or on aquatic plants; the constituent cells being mostly held together by a gelatinous substratum.

4. The VOLVOCINEÆ are green cells provided with 2 or 4 vibratile cilia, united in definite groups which move actively throughout life by the vibration of the cilia.

1. The *Diatomaceæ* are remarkable for their flinty coats, which are beautiful microscopic objects, and which by their persistence cause the remains of successive generations of these plants to become accumulated into enormous deposits, forming even strata many feet in thickness. Tripoli, a kind of polishing powder, is a soft rock, composed chiefly of the coats of Diatomaceæ. The city of Richmond, in Virginia, stands on a stratum of Diatomaceous shells 18 feet thick. The white mineral substance called Mountain Meal (*Berg-mehl*), mixed with flour in times of scarcity, consists of shells of Diatomaceæ, &c.

2. The *Desmidiaceæ* are very elegant microscopic objects. They are common in all fresh-water pools.

3. The most interesting of the *Palmellaceæ* are the *Protococcus nivalis,* Red-snow plant; the *Protococcus viridis,* or green slime of standing water ("green matter" of Priestley), and *Chlorococcum vulgare,* the green pulverulent matter spreading over old palings, trunks of trees, &c.

4. The *Volvocineæ* are often included among Infusorial Animalcules, but all their characters are truly those of vegetables, except the motion, and this, as effected by the 2 or 4 vibratile cilia, occurs also in undoubted plants elsewhere, namely, in the zoospores of the Confervoids and Fucoids. *Volvox globator,* the Globe-animalcule, is common in pools, and *Gonium pectorale,* the Breast-plate-animalcule, is not rare; both are very beautiful microscopic objects.

ANALYTICAL TABLE

OF THE

NATURAL ORDERS OF THE VEGETABLE KINGDOM,

INCLUDING MANY WHICH ON ACCOUNT OF THEIR MINOR IMPORTANCE ARE OMITTED IN THE PRECEDING DESCRIPTIONS.*

CRYPTOGAMIA.

A. Cellular Plants, growing at their circumference. I. Thallophytes.
B. Leafy Plants, growing at the extremity of the axes. II. Acrogens.

PHANEROGAMIA.

CLASS I.—MONOCOTYLEDONS.

A. Endospermous (seeds with albumen).	Calyx free	III.
	— adherent . . .	IV.
B. Exendospermous (seeds without albumen).	Calyx free	V.
	— adherent . . .	VI.

CLASS II.—DICOTYLEDONS.

A. Apetalous (flowers without petals).
  1. Flowers diclinous (staminate and pistillate distinct).
      In catkins . . . . VII.
      Not in catkins . . . . VIII.
  2. Flowers perfect . . . . IX.

B. Gamopetalous (the petals united into one piece).
  1. With a free ovary.
      a. Isostemonous, *i.e.* stamens corresponding in number to the petals, corolla regular, stamens alternate . . . . X.
      b. Anisostemonous, *i.e.* not corresponding, corolla irregular . . . . XI.
      c. Isostemonous, corolla regular, stamens opposite XII.
      d. Anisostemonous, corolla regular . . . . . XIII.
  2. With the calyx adherent to the ovary . . . . . . XIV.

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* Slightly modified from Richard.

C. Polypetalous (the petals distinct).

1. Perigynous (petals and stamens inserted on the calyx).
    - a. Placentas axile . . . . XV.
    - b. — parietal . . . . XVI.
    - c. — central . . . . XVII.

2. Hypogynous (the petals and stamens inserted on the receptacle).
    - a. Placentas central . . . . XVIII.
    - b. — parietal . . . . XIX.
    - c. — axile . . . . XX.

CRYPTOGAMIA.

I. Thallophytes: structure cellular; growth taking place at the whole circumference.

A. *Frond membranous, tubercular or filamentous.*

1. Aquatic plants . . . . Algales (p. 107)
2. Terrestrial or parasitic plants . . Lichenales (p. 106).

B. *No frond; receptacles of the organs of reproduction developed upon a filamentous expansion or thallus* (*mycelium*) . . . . Fungales (p. 101).[1]

II. Acrogens: structure cellular or cellulo-vascular, axis and appendages distinct; growth at the extremity of the axes.

A. *Structure cellular.*

1. Stem bearing leaves; more rarely expanded into a frond.
    - * Capsules operculate, with a columella . . . . Muscaceæ (p. 99).
    - ** Capsules without an operculum, columella rare . . . . Hepaticaceæ (p. 100).

B. *Structure cellulo-vascular.*

1. Stem leafless, capsules in terminal cones, spores with elastic filaments Equisetaceæ (p. 98).
2. Stem leafy.
    - * Capsules axillary to the leaves or to the bracts of terminal catkins Lycopodiaceæ (p. 95).
    - ** Capsules minute, collected in heaps on the inferior surface or in the substance of the leaves . . . . Filicaceæ (p. 96).
    - *** Capsules in the form of large fruits, stalked at the bases of the leaves Marsileaceæ (p. 95).

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[1] The Orders of these Classes need not be dwelt upon here.

PHANEROGAMIA.

CLASS I.—MONOCOTYLEDONS.

. . . .

III. *Exendospermous Monocotyledons with a free ovary.*

- 1. Perianth wanting, replaced by a scale or spathe . . . . **NAIADACEÆ** (p. 87).
- 2. Perianth composed of six pieces . **ALISMACEÆ** (p. 83).

IV. *Exendospermous Monocotyledons, with the calyx adherent.*

- 1. Stamens not coherent with the style. **HYDROCHARIDACEÆ** (p. 82).
- 2. Stamens gynandrous.
  - *Ovary one-celled . . . . **ORCHIDACEÆ** (p. 71).
  - **Ovary three-celled . . . . **APOSTASIACEÆ.**

V. *Endospermous Monocotyledons with a free ovary.*

†Perianth wanting or formed of scale-like pieces.

I. *One stigma to each cell of the ovary.*

- 1. Leaves with irregularly ramified venation, spathe usually enveloping the flowers. . . . . **ARACEÆ** (p. 86).
- 2. Leaves with parallel veins, spathe wanting or not enveloping the flowers.
  - a. Leaves bifid or palmifid . . . **CYCLANTHACEÆ.**
  - b. Leaves entire
    - Embryo cylindrical, axial . **TYPHACEÆ** (p. 84).
    - Embryo discoidal, peripherical at the end of the albumen . **RESTIACEÆ.**

II. *Two or three stigmas on a one-celled ovary.*

- *A single scale to each flower; sheath of the leaves entire . . . . . . **CYPERACEÆ** (p. 88).
- **At least two scales to each flower; sheath of the leaves split . . . **GRAMINACEÆ** (p. 89).

††Perianth of six pieces, three interior and three exterior.

A. *Carpels distinct or with the ovaries coherent; styles distinct.*

- 1. Stem woody; cells of the ovary one-seeded . . . . **PALMACEÆ** (p. 84).
- 2. Stem herbaceous; cells many-reeded **MELANTHACEÆ** (p. 80).

B. *Carpels wholly confluent.*

- 1. Three distinct stigmas.
  - a. Embryo antitropous . . . . **XYRIDACEÆ.**
  - b. Emb. homotropous
    - Calyx glumaceous **JUNCACEÆ** (p. 82).
    - Calyx petaloid . **TILLANDSIACEÆ.**

2. One simple stigma.
a. Embryo erect . . . . Pontederiaceæ.
b. Embryo inverse . . . . Commelynaceæ (p. 82).
3. One three-lobed stigma.
a. Cells with many ovules; fruit dry Liliaceæ (p. 77).
b. Cells with few ovules; fruit fleshy Asparagaceæ (p. 79).

VI. *Endospermous Monocotyledons, with the calyx adherent.*

A. *Six stamens; rarely five.*

1. Perianth usually regular.
*Albumen horny { Calyx spreading Dioscoreaceæ (p. 81).
Calyx tubular . Hæmodoraceæ (p. 74).
**Albumen fleshy { Capsule 3-celled Amaryllidaceæ (p. 78).
Fruit fleshy, 1-celled . . . Taccaceæ.
***Albumen mealy . . . . Bromeliaceæ (p. 75).
2. Perianth always irregular; 5 stamens, rarely 6 . . . . Musaceæ (p. 73).

B. *Three stamens.*

*Opposite the petals. . . . . . . Burmanniaceæ.
**Opposite the sepals . . . . Iridaceæ (p. 75)

C. *One stamen alone fertile, rarely two.*

*Pollen pulverulent; petaloid appendages inside the perianth.
a. Anther 2-celled . . . . . Zingiberaceæ (p. 73).
b. Anther 1-celled (halved) . . Marantaceæ (p. 73).

CLASS II.—DICOTYLEDONS.

1st Division.—Apetalous.

VII. *Diclinous (stamens and pistils on separate flowers), Apetalous Dicotyledons with the flowers in catkins.*

†*Calyx adherent.*
*Ovary one-celled.
a. Leaves alternate { Trunk simple. Cycadaceæ (p. 94).
Trunk branching . . . Coniferæ (p. 91).
b. Leaves opposite . . . . Gnetaceæ (p. 91).
**Ovary two or more celled . . . . Cupuliferæ (p. 68).

††*Calyx free.*
*Embryo without albumen.
a. Ovary one-seeded.
Ovule erect; fruit simple . . Myricaceæ.
Ovule suspended; fruit in a cone Betulaceæ (p. 68).
b. Ovary many-seeded . . . . . Salicaceæ (p. 67).
**Embryo with albumen . . . . . Piperaceæ (p.64).

VIII. *Diclinous Apetalous Dicotyledons, flowers not in catkins.*
A. *Calyx free.*
†Embryo with albumen.
1. Fruit one-celled, one-seeded, indehiscent.
Leaves alternate; stipulate . . URTICACEÆ (p. 66).
Leaves opposite; no stipules . MONIMIACEÆ.
2. Fruit composed of three 1—2-seeded cocci . . . . . . EUPHORBIACEÆ (p. 64).
3. Fruit fleshy, 1-seeded, indehiscent MYRISTICACEÆ (p. 60).
††Embryo without albumen.
1. Fruit 1-seeded, indehiscent.
Stamens bursting by valves . LAURACEÆ (p. 59).
Stamens bursting by slits . . HERNANDIACEÆ.
2. Fruit capsular, many-seeded . . PODOSTEMACEÆ.

B. *Calyx adherent* (parasitical plants).
†Ovary one-celled; one-seeded . . . BALANOPHOREÆ (p. 70).
††Ovary many-seeded.
Anthers bursting by a pore . . RAFFLESIEÆ (p. 70).
Anthers bursting by a slit . . . CYTINEÆ (p. 70).

IX. *Apetalous Dicotyledons with perfect flowers* (hermaphrodite).
A. *Calyx adherent.*
1. With six many-seeded cells . . ARISTOLOCHIACEÆ.
2. With a single few-seeded cell . SANTALACEÆ.
B. *Calyx free.*
†Embryo with albumen.
*Several distinct carpels, containing from 2 to 4 ovules . . . . . SAURURACEÆ.
**Several carpels coherent into an ovary with one-seeded cells . . PHYTOLACCACEÆ.
***One carpel, or several carpels cohering to form a one-celled ovary.
a. A single stigma { Linear . . . . ELEAGNACEÆ.
Capitate { Embryo straight. THYMELEACEÆ.
Emb. rolled round a mealy albumen NYCTAGINACEÆ.
b. Two or three stigmas.
*Embryo antitropous, lateral. POLYGONACEÆ (p. 61).
**Embryo homotropous, embracing the albumen.
Floral envel. herbaceous . CHENOPODIACEÆ (p. 62).
Floral envel. scaly at least at the margins. . . . AMARANTHACEÆ (p. 62).
††Embryo without albumen.
Embryo homotropous . . . . PROTEACEÆ (p. 63).
Embryo antitropous . . . . . AQUILARIACEÆ.

2D SUBDIVISION.—GAMOPETALOUS.

X. *Gamopetalous Dicotyledons, Isostemonous, with a regular Corolla and alternate Stamens.*

I. *A single carpel, 1-celled, with 1 ovule.*
  a. Three to five stigmas . . . . PLUMBAGINACEÆ (p. 58).
  b. A single bilobed stigma . . . GLOBULARIACEÆ.

II. *Several carpels or cells, containing from 1 to 4 ovules.*
  a. Carpels distinct.
    Embryo curved round the albumen NOLANACEÆ.
    Embryo straight; usually without albumen . . . . BORAGINACEÆ (p. 50).
  b. Carpels coherent.
    Placentation axile . . . . . CORDIACEÆ.
    Placentation basilar. . . . . CONVOLVULACEÆ. (p. 51).
    Placentation parietal . . . . HYDROPHYLLACEÆ.

III. *Carpels or cells, with many ovules.*
  a. Carpels coherent.
    † Embryo straight.
      Several styles . . . . HYDROLEACEÆ.
      A single style.
        Placentas parietal . . . . GENTIANACEÆ (p. 50).
        Placentas axile or basilar.
    ‡ No stipules.
      * Ovary 3-celled . . . . POLEMONIACEÆ.
      ** Ovary 1—2-celled . . . . . PLANTAGINACEÆ (p. 58).
    ‡‡ Leaves stipulate . . . . . . LOGANIACEÆ (p. 49).
    †† Embryo curved . . . . SOLANACEÆ (p. 53).
  b. Two distinct carpels.
    Pollen pulverulent . . . . APOCYNACEÆ (p. 48).
    Pollen in solid masses . . . . ASCLEPIADACEÆ (p. 49).

XI. *Gamopetalous Dicotyledons, with the Calyx free. Anisostemonous (St. 2—4) Corolla usually irregular.*

I. Several carpels coherent.
  A. *Cells with many ovules.*
    1. Ovary 1-celled.
      a. Placentation basilar, central LENTIBULARIACEÆ.
      b. Placentation parietal.
        Foliaceous plants (calyx sometimes adherent) GESNERACEÆ (p. 51).
        Leafless plants . . . . OROBANCHACEÆ (p. 55).
    2. Ovary 2-celled.
      Embryo with albumen . . . SCROPHULARIACEÆ (p. 54).
      Embryo without albumen . . BIGNONIACEÆ (p. 51).
  B. *Cells with 1—2 ovules; rarely several.*
    * Corolla regular . . . . JASMINACEÆ.
    ** Corolla irregular.
      a. Capsule two-valved; no albumen ACANTHACEÆ (p. 57).
      b. Fruit dry or fleshy, indehiscent; seeds with albumen.
        † Anthers 1-celled . . . . SELAGINACEÆ.

† † Anthers 2-celled.
Embryo homotropous . . MYOPORACEÆ.
Embryo heterotropous . . VERBENACEÆ (p. 57).
II. Four carpels, 1-celled, 1-seeded, indehiscent and distinct . . . . LABIATÆ (p. 55).

XII. *Gamopetalous Dicotyledons; Calyx free; Isostemonous; Corolla regular; Stamens opposite the lobes of the Corolla.*

1. Fruit capsular, many-seeded . . . PRIMULACEÆ (p. 57).
2. Fruit drupaceous or bacciform, few-seeded . . . . MYRSINACEÆ.

XIII. *Gamopetalous Dicotyledons; Calyx free,*[1] *usually Anisostemonous; Corolla regular.*

1. Anthers 2-celled.
a. Cells of the ovary with 1—2 ovules.
† Flowers perfect, cells with 1 ovule . . . . SAPOTACEÆ.
†† Flowers unisexual, cells with 2 ovules . . . . . . EBENACEÆ.
b. Cells of the ovary few or many-seeded.
† Anthers bursting by pores . ERICACEÆ (p. 47).
†† Anthers bursting by slits . STYRACACEÆ.
2. Anthers 1-celled . . . . . . EPACRIDACEÆ.

XIV. *Gamopetalous Dicotyledons, with the Calyx adherent.*

I. Seeds with albumen.

A. *Leaves alternate.*

† Stamens distinct from the style.
a. Flowers in a cyme or raceme.
Stigma lobed . . . . . CAMPANULACEÆ (p. 46).
Stigma simple, concave . GOODENIACEÆ.
b. Flowers in a capitulum . . . CALYCERACEÆ.
† † Stamens adherent to the style STYLIDIACEÆ.

B. *Leaves opposite, no stipules; albumen fleshy.*

† Flowers with a proper involucre . . . . DIPSACEÆ (p. 43).
† † Flowers naked, fruit fleshy or drupaceous . . . . . . CAPRIFOLIACEÆ.

C. *Leaves opposite, stipulate, or verticillate.*

Albumen horny . . . . . RUBIACEÆ (p. 42).

II. Seeds without albumen.

A. Stamens free . . . . VALERIANACEÆ.

B. Stamens syngenesious . . . . . COMPOSITEÆ (p. 43).

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[1] Rarely with an inferior ovary; some Styracaceæ and the Vaccinieæ among the Ericaceæ.

3D DIVISION.—POLYPETALOUS OR DIALYPETALOUS.

XV. *Perigynous Polypetalous Dicotyledons, with axile Placentas.*

A. *Seeds with albumen.*

† Seeds in a definite number.

a. *Calyx adherent.*

I. Stamens opposite the petals.
Ovary 1-celled, with 1 ovule; leaves opposite . . . . LORANTHACEÆ.

II. Stamens alternate.
1. Embryo cylindrical, almost as long as the albumen . {
Style simple ALANGIACEÆ.
Several styles HALORAGACEÆ.
2. Embryo very small . . {
Albumen horny; æstivation imbricate . . . . . UMBELLIFERÆ (p. 40).
Albumen fleshy; æstivation valvate . . . . . ARALIACEÆ.

b. *Calyx free or only partly adherent.*

I. Stamens alternate.
„ Ovules suspended {
Fruit dry { Opening by 2 valves. . HAMAMELIDACEÆ.
Fruit dry { Separating into 2 cocci . BRUNIACEÆ.
Fruit fleshy . . . . AQUIFOLIACEÆ.
„ Ovules ascending {
No stipules; flowers 2- or 3-merous . . . . . . EMPETRACEÆ.
With stipules; flowers 4- or 5-merous . . . . . . CELASTRACEÆ.

II. Stamens opposite the petals . . . . . RHAMNACEÆ.

†† Seeds indefinite in number.

I. Calyx free . . . . FRANCOACEÆ.

II. Calyx half-adherent; stamens attached to the calyx . . . . SAXIFRAGACEÆ.

III. Calyx adherent; stamens attached to the circumference of the summit of the ovary PHILADELPHACEÆ.

B. *Seeds without albumen.*

† *Calyx adherent.*

I. Leaves without stipules.
a. Flowers polystemonous . . . . MYRTACEÆ (p. 37).
b. Flowers diplostemonous.
1. Fruit many-celled, many-seeded.
Anthers bursting by a pore MELASTOMACEÆ.
Anthers bursting by a slit ONAGRACEÆ (p. 38).
2. Fruit 1-celled, 1-seeded . . . . COMBRETACEÆ.

II. Leaves with stipules; fruit 1-seeded, indehiscent . . . . Rhizophoraceæ.

† † Calyx free.

I. Carpels coherent.
  Flowers regular.
    Fruit capsular . . . . Lythraceæ.
    Fruit drupaceous . . . . Chailletiaceæ.
  Flowers irregular; only 1 stamen . . . . Vochysiaceæ.

II. Carpels free, or only 1 carpel.
  1. Leaves without stipules . {
    Fruit follicular; plants succulent . . . Crassulaceæ.
    Fruit various; cells 1-seeded . . . . Anacardiaceæ (p. 30).
  2. Leaves stipulate . . . {
    Calyx with the odd sepal anterior. Fruit a pod or legume . . . . Leguminosæ (p. 31).
    Calyx with the odd sepal posterior. Fruit dry or fleshy. . . . . Rosaceæ (p. 34).

XVI. *Perigynous Polypetalous Dicotyledons, with parietal Placentas.*

A. *Seeds without albumen.*

Stamens numerous, free, plants succulent . Cactaceæ (p. 39).
Stamens five, triadelphous, twining plants . Cucurbitaceæ (p. 38).

B. *Seeds with albumen.*

I. Embryo straight in a fleshy albumen.
  a. Isostemonous {
    Calyx free, ovary stalked Passifloraceæ.
    Calyx ½ or wholly adhnt. Grossulariaceæ (p. 40).
  b. Flowers diplostemonous; flowers unisexual . . . . Papayaceæ.
  c. Flowers anisostemonous; small trees, no corolla . . . . Homaliaceæ.
  d. Flowers polystemonous; plant herbaceous, corolla with five petals . . . Loasaceæ.
II. Embryo rolled round a mealy albumen . . Mesembryaceæ.

XVII. *Perigynous Polypetalous Dicotyledons, with central Placentas.*

Stamens opposite the petals . . . . . . Portulacaceæ.
Stamens alternate . . . . Paronychiaceæ.

XVIII. *Hypogynous Polypetalous Dicotyledons, with central Placentas* . . . . Caryophyllaceæ (p. 22).

XIX. *Hypogynous Polypetalous Dicotyledons, with parietal Placentas.*

A. *Placentas opposite the valves.*

† Albumen fleshy.
a. Dehiscence septicidal; anthers extrorse . Frankeniaceæ.
b. Dehiscence loculicidal.

1. No stipules . . . . FLACOURTIACEÆ.
2. Leaves stipulate { Fl. isostemonous, anthers introrse VIOLACEÆ (p. 22).
   Fl. diplost. or polystemonous, anthers extrorse DROSERACEÆ.

†† Albumen mealy; embryo curved or rolled round . . . . CISTACEÆ.

††† No albumen.
Fruit dry, dehiscent . . . . . . TAMARICACEÆ.
Fruit fleshy, indehiscent . . . . . MARCGRAVIACEÆ.

B. *Placentas alternating with the valves.*

I. Number of stamens definite.
1. Six tetradynamous stamens; calyx of 4 sepals . . . . CRUCIFERÆ (p. 20).
2. Six diadelphous stamens; calyx of 2 sepals . . . . FUMARIACEÆ (p. 20).

II. Number of stamens indefinite.
1. No albumen, leaves stipulate . . . . CAPPARIDACEÆ (p. 21).
2. Albumen fleshy { Embryo amphitrophous . . RESEDACEÆ (p. 22).
   Embryo orthotropous . . . PAPAVERACEÆ (p. 18).

XX. *Hypogynous Polypetalous Dicotyledons, with axile Placentas.*

† *Albumen double, or wanting.*

I. Carpels adherent, many-seeded. . . . . NYMPHÆACEÆ (p. 17).

II. Carpels distinct.
„ One-seeded, on a fleshy receptacle . . NELUMBIACEÆ (p. 18).
„ Two-seeded, without a receptacle . CABOMBACEÆ.

†† *Albumen simple.*

A. *Embryo very small, at the base of a voluminous albumen.*

I. Carpels distinct.
a. Stamens numerous.
   Calyx of 4—5 sepals { Seed without arillus RANUNCULACEÆ (p. 15).
   Seed with an arillus DILLENIACEÆ.
   Calyx of 3 sepals { Leaves stipulate . MAGNOLIACEÆ (p. 16).
   No stipules . . . ANONACEÆ.
b. Stamens in a definite number, opposite . . . . LARDIZABALACEÆ.

II. Carpels coherent.
a. Stamens alternate . . . . PITTOSPORACEÆ.
b. Stamens opposite { Anthers bursting by valves . BERBERIDACEÆ (p. 17).
   Anthers bursting by slits . . VITACEÆ (p. 28).

B. *Embryo axial, almost as long as the albumen.*

* Æstivation of the calyx imbricate.

I. Stamens definite.

Embryo amphitropous; flowers unisexual					MENISPERMACEÆ.
Embryo orthotropous	Stamens free	3—5 carpels			RUTACEÆ (p. 30).
		A single carpel			OLACACEÆ.
	Stamens coherent	Monadelphous	fruit many-celled; cells with 2 ovules	Style simple	MELIACEÆ.
				Style multiple	LINACEÆ (p. 27).
			Cells with many ovules		CEDRELACEÆ.
			Fr. 1-celled; 1-seeded		ERYTHROXYLACEÆ.
		Diadelphous			POLYGALACEÆ.

II. Stamens indefinite	Leaves stipulate; stamens monadelphous	CHLENACEÆ.
	No stipules; stamens free	TERNSTRŒMIACEÆ (p. 29).

* * Æstivation of the calyx valvate.

I. No stipules; stamens definite, free	TREMANDRACEÆ.
II. Leaves stipulate.	
1. Stamens monadelphous.	
Anthers 2-celled	BYTTNERIACEÆ (p. 25).
Anthers 1-celled	STERCULIACEÆ (p. 24).
2. Stamens free	TILIACEÆ (p. 25).

† † † *Seeds without albumen.*

* Æstivation of the calyx valvate.

Stamens monadelphous, anthers 1-celled	MALVACEÆ (p. 23).
Stamens free, anthers 2-celled	DIPTERACEÆ.

* * Æstivation of the calyx imbricate.

I. Stamens indefinite.

Leaves opposite	Without punctations	GUTTIFERÆ (p. 26).
	Punctate	HYPERICACEÆ (p. 26).
Leaves alternate; fruit fleshy		AURANTIACEÆ (p. 28).

II. Stamens definite.

Flowers isostemonous	irregular		BALSAMINACEÆ.
	regular		HIPPOCRATEACEÆ.
Flowers anisostemonous			ÆSCULACEÆ.
Flowers diplostemonous	Leaves stipulate	cells 1-ovul.	MALPIGHIACEÆ.
		cells 2-ovul.	GERANIACEÆ (p. 27).
	No stipules.	Leaves opposite	ACERACEÆ.
		Leaves alternate. Compound	SAPINDACEÆ.
		Leaves alternate. Simple	OCHNACEÆ.

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